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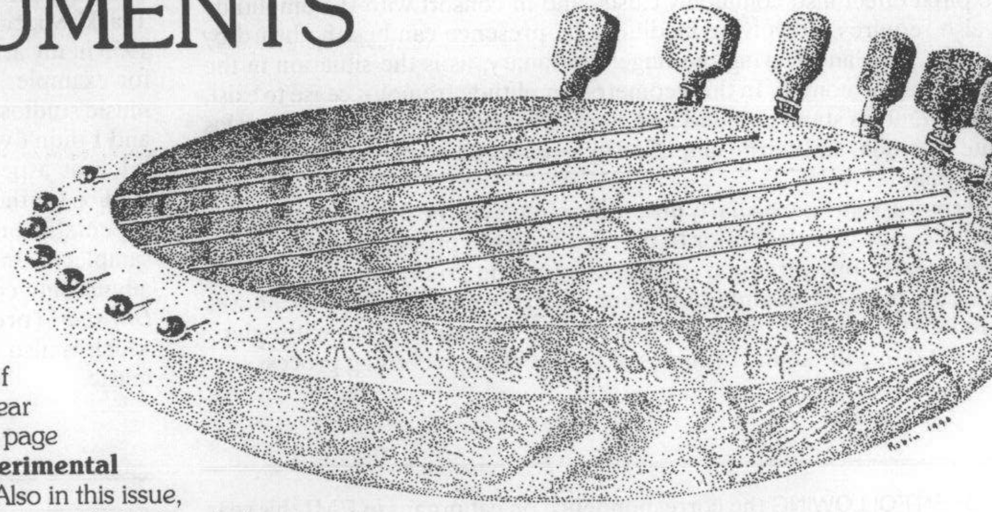
FOR THE DESIGN, CONSTRUCTION AND ENJOYMENT OF UNUSUAL SOUND SOURCES

EXPERIMENTAL MUSICAL INSTRUMENTS



Drawing by Robin Goodfellow, from a photograph by Tobias Kaye

AND WHETHER PIGS HAVE WINGS

The beautiful musical bowl that appears at right is the work of wood turner Tobias Kaye. Photographs of several of his pieces appear in the article beginning on page 10 of this issue of **Experimental Musical Instruments**. Also in this issue, Sascha Reckert reports on two of his glass instruments, the glass organ and verrillon, and provides background on some of the earlier instruments that inspired them. David Myers addresses the question of how to create individualized electronic instruments in a world of mass-produced components, and describes his own feedback instrument. Following our features of a year ago on whirlies and corrugahorns, we take a further look at the possibilities for corrugated tube aerophones. And, starting here on this page, Richard Graham introduces a family of new world African American glissed chordophones that share richly in the spirit of early blues. There are more things to be found in these pages as well — but let us turn now to the sliding strings.

IN THIS ISSUE

THE DIDDLEY BOW IN A GLOBAL CONTEXT

By Richard Graham

Having been involved in the music of West and Central Africa and the diaspora as both a performer and instrument builder, I have often wondered why some Africanists have persisted in the use of such terms as "traditional" and "primitive" to describe musical instruments. Innovation and ingenuity are better terms to describe the reality of African organology, which has been in a state of flux since pre-history.

This is perhaps nowhere more evident than in the New World, where African oganological change was accelerated through the interpenetration of African and European music cultures, and the introduction of new building materials and methods. What resulted

(Continued on page 10))

TO START WITH, I'M OVERJOYED with the response to my article ["Notes on the Musical Glasses," EMI, August 1990]. It's fine to know so many people enjoy physics so much.

In return, I'd like to offer a short note on Michael Meadows' note on my note [EMI's Letters section, December 1990].

Michael is certainly right that the principal tremolo heard when a glass is played is an amplitude effect. This can easily be proven by aligning your ear with the axis of the glass. In this position, the amplitude effect disappears, leaving only a pitch effect (if one is present).

The pitch effect also commonly exists, and in consort with the amplitude effect also requires a revolving medium. Its presence can best he heard by rotating the glass and leaving the finger stationary, as is the situation in the Franklin glass harmonica. In this geometry, amplitude tremolos cease to exist, and pitch tremolos stand out loud and clear. I have found that pitch tremolos are quite common, and can be amplified by swishing the water a bit in the glass while playing.

Furthermore, some particularly unsettling effects can be produced by gluing screws to the side of a glass prior to playing. With the proper mass applied to the screw, whole tone variations in frequency can be produced.

Finally, the presence of amplitude tremolos in the musical glasses behooves one to record the sound from a microphone suspended directly above the glass. If this is not done, the sound becomes distorted in the recording process.

Ed Stander

I HAVE BEEN FOLLOWING the correspondence on cat organs in EMI this year with interest. Here are a couple of further aspects, mostly based on the final paragraph of my article "Sound Effects" in The New Grove Dictionary of Musical Instruments; some of my information sources are no longer easily accessible.

Dennis James' cat notation in EMI Volume VI #3 is sometimes attributed to Franz Schubert, but a more likely attribution is to one of his closest friends, the painter Moritz von Schwind (1804-71). The Italian logo from which the illustration was taken omits several details: the tempo *allegretto*, eight more staves of notation, including three other movements (*Andante, Grave* and *Presto Finale*), and the heading *Violino* -- implying a chamber or orchestral work.

In concentrating on cats, your correspondents have neglected other domestic animals, including white mice (recreated in a sketch by Monte Python's Flying Circus) and pigs (unfortunately I can't find the illustration of a Sigñor Swinetta pulling the tail of a pig held under one arm). The British composer Richard Blackford wrote an opera **The Pig Organ** in 1980. An animal organ is featured in at least one Walt Disney cartoon -- I can't remember which animal(s)? Finally (and this is genuine) a choir of trained canaries was started in the early 1950s in Kharkov in the Soviet Union, and by 1980 it had a repertoire of nearly 100 pieces, from Beethoven and Shostakovich to Russian folk songs; birds were specially bred to sing the bass parts.

On a very different subject, I would like to explain to Colin Hinz (letter in EMI Volume VI #3) why museums need to disable some controls on 'hands-on' synthesizers. Unlike electronic organs and electric pianos, synthesizers have a large number of controls, some of which, when operated on their own, can cause the sound to be cut off. If an instrument is intended to be available for the public to play, it must be set up in such a way that it can always be played; imagine that one novice hits various buttons randomly and leaves the machine with incomplete programming instructions, which the next novice doesn't understand and therefore assumes that the instrument is broken.

It's rather late now, but I would like to take this opportunity to answer Colin Hinz's earlier letter (Vol. V #4) about the omission of Hugh Le Caine in my "History of Sampling" (Volume V #2). I have seen several of Le Caine's instruments in Canadian electronic music studios (and wrote about them all in **The New Grove Dictionary of Musical Instruments**), read virtually all of his writings and even visited him many years ago in his lab, so I yield to no one in my admiration of his achievements. Indeed I could have mentioned his 'Multi-Track' Special Purpose Tape Recorder of 1955 in my article, but, unlike the Mellotron for example, it was intended for electronic music studios rather than live performance, and I didn't want to do more than touch on relevant aspects of the beginnings of tape studios (in the sense that any tape recorder, especially one with variable speed, is a sampler). Incidentally, the 1967 Folkways album only contained one Le Caine piece, *Dripsody* (produced on the Multi-track), which is also on the new LP devoted to his music.

Hugh Davies

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SUBMISSIONS: Experimental Musical Instruments welcomes submissions of articles relating to new or unusual musical instruments. A query letter or phone call is suggested before sending articles. Include a return envelope with submissions.

NOTES FROM RECENT CORRESPONDENCE

LONG TIME EMI SUPPORTER BIL KING recently sent along photographs of one of his projects, a long string-scale electroacoustic stick zither which he refers to as *the Board*. Readers have often shown interest in instruments made along these lines, so the editor asked Bil to send some background information to go with the photos. Here are his notes:

In late 1989, being influenced by the work of Glen Branca, Ivor Darreg, Fred Frith, Micky Hart, Elliott Sharp and Don Ho, I began building a series of simple monochords. These have mutated into an instrument that I really like.

The instrument, still simple, is made from a 2" x 10" x 8′ paduk board, beautiful and politically incorrect, but quite stout and not given to warpage as was its fir prototype. There are fourteen seven foot strings — steel piano treble wire, gauges 8, 12 and 17 — stretched over the board. Sierra Instruments of Portland made the pickups and Eugene luthier Roscoe Wright installed them. Tell 'em I sent you.

So far, I've kept the tuning pretty high, but I've played around with a lot of different tunings. Even tried standard pedal steel for the first ten strings and cello for the last four. To tell the honest truth, unless the strings are way, way out of whack, it doesn't bother me. Blasphemy, I know.

Sometimes I take advantage of a third bridge set between the "nut" and the "bridge," in which case the pickup side is very different from the other side. With or without the third bridge, there is a nice gamut of tones — from ultra urban funk to new age ethereal to, well, pretty weird country western/Hawaiian. Sometimes I use couple of E-bows and a delay to spice things up.

While I have never considered myself a musician, I can spend hour after hour playing this instrument. There's a lot to explore in the world of sound and these types of instruments are great tools.

Bil King holding the 8 foot, 14-string Board.

MORE ON PYROPHONES: Quite some time ago, in EMI Volume III #4 and 6 (Dec. '87 and April '88), there appeared in EMI's letters section a running series of letters from various correspondents on the subject of pyrophones. The pyrophone is an organ-like instrument originally created by the French physicist Georges Frédèric Eugène Kastner around 1875, and described in his **Les Flammes chantantes** (Paris, 1875). It uses gas flames burning within an air column to generate the tones. Michael Meadows (one of the correspondents mentioned above) suggested that the oscillations come about as the flame heats the air immediately around it, causing expansion and rarefaction in the air and a resulting relative dearth of oxygen, which causes the flame to diminish. The pressure wave resulting from the heated air, meanwhile, travels to the end of the pipe and is partially reflected back (as with all tuned air column instruments). The returning pressure wave again provides the flame with more compression in the air and correspondingly more oxygen; the flame increases again and the cycle repeats.

At the time that the original exchange of letters was taking place, François Baschet sent along a copy of the section dealing with pyrophones in the second volume of H. Bouasse's **Instruments à vents** (Paris, 1929-30). The original was in French, and we have only just recently arranged to have it translated. Begging pardon for the long delay, we reprint it now, along with the original diagram.

From Bouasse **Instruments a vents** Volume II
Translation by Zack Rogo, Benemann Translation Center, San Francisco.

PYROPHONE.

1st. In a pipe 55 cm. long (diameter: 40 mm.), Kastner placed two hydrogen flames, in roughly the lower third of the pipe (fig. 59). Separated, they produce an F = 342; as soon as one draws them nearer to each other, the pipe stops speaking.

These are the frequencies for the various lengths or L; they are calculated with the speed of sound V = 340m., assuming that the pipe contains a half-wavelength of the observed frequency:

Lengths			
L =	55cm.	65cm.	97cm.
Calculated frequencies	310	261	175
Observed frequencies	F3 = 342	D3 = 288	G2 = 192

This result [i.e., discrepancies between predicted and observed frequencies] was predictable, given the temperature of the gas in the pipe.

If we move the flames farther apart in the pipe, the intensity of the sound, dead when they are in the middle of the pipe, increases when one moves them downward: it is maximized when the flames are at one quarter of the length.

When we bring the flames back together, the sound does not disappear when they are at the position of greatest intensity; the flames continue to "vibrate" as a single flame.

To deaden the sound, they must be placed outside of the maximum position, for instance at a third of the length.

The results remain the same with pipes varying in length from 10 to 280 cm. and with diameters remaining 4 to 5 cm.

If the pipe is wider, one raises the number of flames from two to three. It must take the shape of a very neatly formed spindle: the length has very little effect on the phenomenon.

2nd. Role of Solid Bodies in the Flame

To make a musical instrument with the flames, one must replace the hydrogen with gas used for lighting: these illuminating flames (containing solid carbon) are more musical. One can make a pipe speak with hydrogen (a non-illuminating flame); then one bubbles the hydrogen in the benzine: the flame becomes illuminating; but the pipe refuses to speak.

The pipe only speaks with gas used for lighting if the flame is very low, in such a fashion as to diminish its volume with respect to the surface that is in contact with the atmosphere. To obtain an intense sound, one must increase the number of flames.

3rd. Pyrophone.

Figure 59 demonstrates the mechanism which can be used to draw the flames near to each other or pull them apart (let's assume seven of them, forming a crown). The gas flows through a central column, then gets to the burners through rubber tubes. The tubes of the burners revolve around horizontal axes (large black dots); their angle is changed by means of a ring which slides over the central column and which are manipulated by draw strings connected to a keyboard.

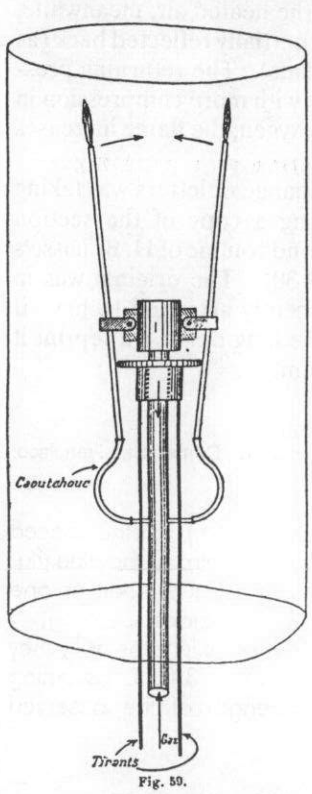


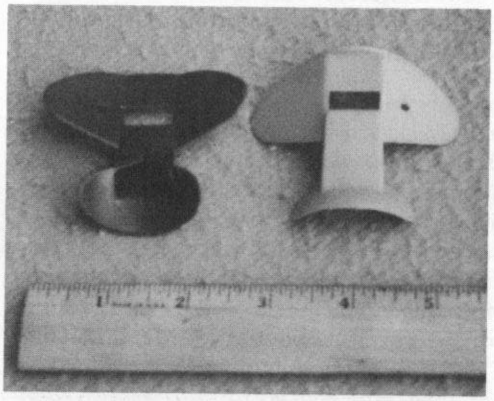
Fig. 59.

Bouasse's arrangement for gas flames within a pyrophone tube. Terms appearing in the diagram: Caoutchouc = rubber; Gaz = gas; Tirants = strings.

I don't know if the instrument has ever been built; Kastner's booklets only describe the pipe. The difficulties of copying it seem insurmountable, given that for an instrument of six octaves (72 notes), one would need 300 to 400 flames.

EASY TO PLAY! FUN FOR KIDS & ADULTS!

Trophy Music Company in Cleveland, Ohio, produces a patented device under the name Nose Flute, which they sell through various catalogs for a dollar or two. EMI's chief executive, recognizing value and utility, ordered two of them for use in the office. The nose flute, we learned on its arrival, is comprised of a small piece of molded plastic, with a smaller upper shield which fits over the nostrils, and a larger lower shield that fits shield made to fit over the player's mouth. The upper shield contains the entry to a fipple, which directs air from the nostrils down over the edge of an opening located in the lower shield in front of the player's mouth. The edge tone thus generated works in conjunction with the resonance of the oral cavity to create the sound, with pitch controlled primarily by the aperture -- that is, by how much the player opens his or her lips. The thing speaks very easily, with a reasonably clear recorder-like tone. It is difficult, for beginners at least, to control pitch accurately, but for a buck, who's complaining?



The famous Trophy Music Company Nose Flute, U.S. Patent # 2245432

HOW ABOUT AUDIBLE LABELING ON FUTURE EMI CASSETTES?

A recurrent problem with audio cassette tapes lies in the fact that it's often difficult for the listener to identify which track he or she is listening to at a given moment. The tape itself appears completely undifferentiated; there's no easy way to find a particular track short of searching up and down the tape, listening to snatches and hoping it is somehow recognizable by the character of the sound. Trying to associate information in the liner notes with the right tracks on the tape can become quite a chore. I have found this frustrating even for tapes provided with good written documentation. A simple partial solution to the problem is to put a voice at the start of each cut announcing what it is that's about to be heard.

Should we do this on future EMI tapes?

I do think the idea has advantages. But whenever I consider it, I stumble at the same spot: what sort of voice would be appropriate for the announcement?

Some possibilities: 1) Resonant male advertising copy reader. 2) No-public-speaking-training regular guy. 3) Soothing smooth alto. 4) Upbeat hype type. 5) Donald Duck. 6) Vocoder. 7) Imitation continental suave, performed by someone who doesn't really know how to do a French accent. 8) Pig Latin. 9) Retrograde inversion. 10) Computer-generated monotone. 11) Helium-inhalation voice. 12) Game-show hysterical/giggly. 13) Gomer Pyle. 14) William F. Buckley. 15) Howard Cosell. 16) Mike Tyson. 17) Auto salesman.

Opinions on this topic are welcome.

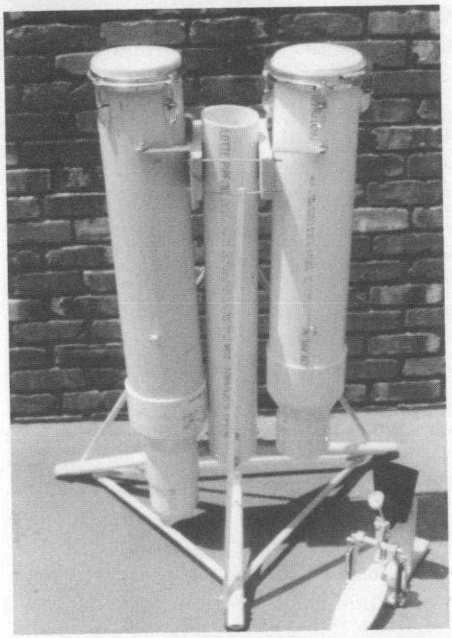
CORRECTIONS

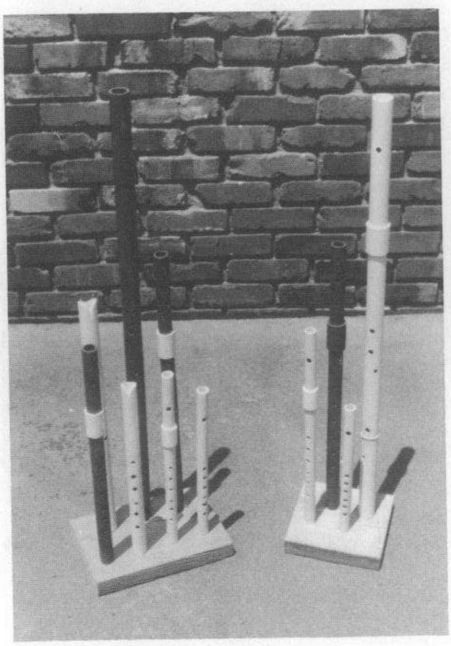
On page one of EMI's last issue (December), reference was made to the **Artspirit Sings** sound sculpture exhibit in Minnesota. The exhibit is in fact in Wisconsin, as correctly stated in the article on the subject in the same issue.

BEN SAFERSTEIN of Pittsburgh, PA has recently created a set of PVC tubing instruments, and he sent along the photographs printed here. His accompanying notes are printed below the appropriate photos; they are especially valuable for their straightforward observations on just which instruments and approaches worked well and which didn't.

"The project went a long way," Ben comments, "in helping me keep sane and healthy while teaching at a boarding school. I took the flutes up to the instrument makers fair at the American Recorder Society's Workshop in Amherst, MA last summer. I sold enough to cover expenses, and got some odd looks from the serious recorder and flute makers (possibly because my renaissance tenor flutes played about as well and sounded as good as theirs, but were priced quite a bit less)."

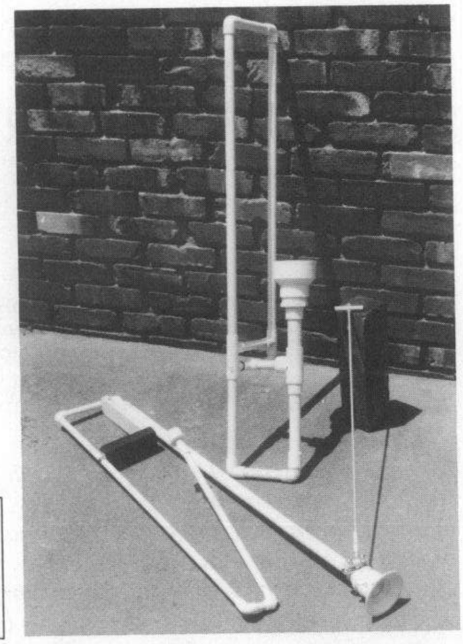
1. The CONGA DRUMS are probably the most successful. I used some pieces of scrap 6" schedule 40 pipe given to me by a friendly building contractor (that stuff's not cheap). I picked up the calfskin heads and drum hardware at Ted's Music in Baltimore, near the Peabody Conservatory (a fabulous store for all kinds of used instrument parts, but which recently had a fire). Note the 6" to 4" PVC couplings which narrow the ends, thus improving the overtone response. I can tune the lower drum by adding different lengths of 4" pipe, which is much easier to find than 6". They sound as good as anything Latin Percussion has come up with.





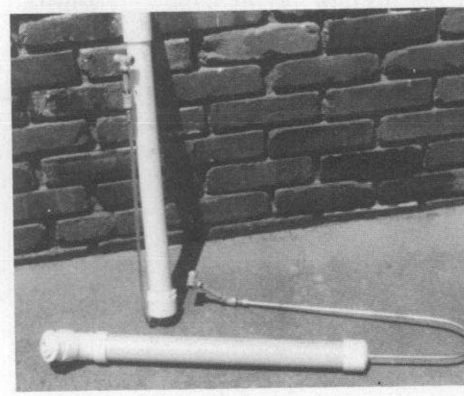
2. The FLUTES also came out well. On the right is a standard renaissance flute quartet (pitched g, d', g' and d' '). The third hole from the bottom on the bass flute is operated in back with the thumb; the elastic band goes around the free middle finger for control. The tenor flutes are made from schedule 80 PVC, which is a bit thicker than the standard schedule 40 and helps the intonation. Note also the end blown flutes on the left, basically the same as Andean Cana. The tone holes are placed so they use recorder fingerings, which makes them a little more accessible to most classically trained musicians.

3. The SLIDE TROMBONES suffer from a weird overtone series due to the stepped cylindrical rather than smooth conical bore. They also lack definition in the upper range, likely because they're not airtight. The mouthpiece is a 1" to 1/2" PVC coupler with a piece of 1/2" CPVC inserted. The size is not optimal, but the shape is quite similar to a standard brass mouthpiece.

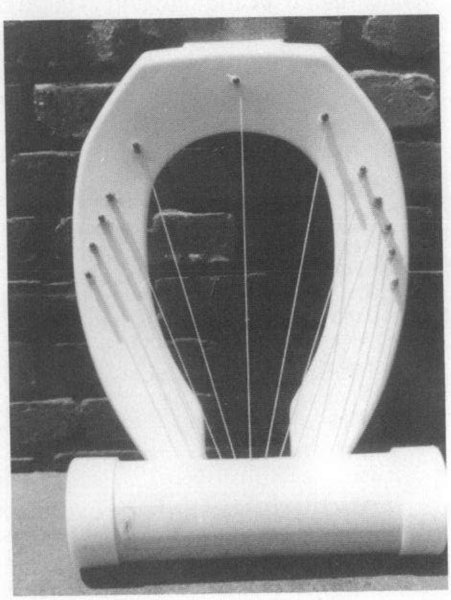


Note: PVC, or polyvinyl chloride, is toxic. Precautions should be taken in cutting, sanding or heating, or where direct oral contact will occur.

4. The SLIDE WHISTLES work pretty well. I used rubber test plugs as the internal stoppers, because they can be adjusted for a precise fit in the pipe. Compression fittings are used to attach the test plugs to the steel rod handles. Several bushings at the top give them a bottle-like mouthpiece, and they are blown transversely. I did some work on making fipple mouthpieces out of flexible vinyl tubing, but never completed any whistles with them.



5. Finally, there is the TOILET SEAT HARP which is better as a visual effect than as an instrument. I suppose it's really a lyre, since the strings alternate from side to side in a diatonic scale, like a kalimba. Piano pins are held in the seat with 3/8" outer diameter 1/4" inner diameter vinyl tubing, which is the right size to grip the pins tightly but allow for tuning. The strings go directly into a piece of 4" thin wall PVC which is a functional but slightly disappointing resonator. I should have made some kind of rigid bridge for the strings to go over. The pipe bends with the tension of the strings, which alters the length and tension, causing a tuning problem. One has to painstakingly make minor adjustments until the whole instrument reaches equilibrium.



A PERSONAL SYSTEM FOR ELECTRONIC MUSIC

By David Myers

This article was originally published in the ReR Quarterly, a sound and print magazine dedicated to new, non-academic music, extended instruments and techniques, and manipulated recording (LP & Magazine: L9; subscription of 4 issues with special supplements L32, from ReR Megacorp, 19-23 St. Saviours Rd., London SW2 UK).

David Myers is the designer and builder of The Feedback Machine, *an electronic music making system made up of a matrix of interconnected digital delay lines and other signal processors. For raw material it samples snatches of ambient electron movement from within the system itself, and amplifies, modifies, and extensively recycles them to create a palette of diverse and unexpected timbres.*

In this article David begins by speaking in a general way about possibilities for individuality in a mass market of identically produced electronic music components. He then goes on to describe his own "personal music system."

I first became involved with electronically-based music production in the dim prehistory known as 'before MIDI'. At that time (circa 1980), constructing one's own synthesizers, processing gear, etc., was a practical alternative to buying a commercially-produced unit. Plans, and even complete kits, for such projects were not difficult to find -- true to a degree even now -- and with enough patience, an enterprising amateur with a soldering iron could actually come up with a very complete electronic music studio. Modular synths[a], analog delays, mixers, EQ[b], whatever ... just add a tape recorder, and you were set! The quality of the gear I came up with at that time compared quite favorably to commercial equipment, and at a small fraction of the cost.

Now, only a few years later, things are very different; no one will be found trying to build their own DX7[c]! There are two reasons for this shift concerning D.I.Y.[d] practice: 1) the advent of digital technology, and 2) large corporations becoming involved in electronic instrument design and manufacture. It is now possible, through digital means, to produce sonic manipulations of startling variety and quality. But things such as FM synthesis and digital reverb have come about through major research and development, custom integrated circuit design and manufacture, etc. -- in short, massive funding. The basement inventor is no threat to Yamaha or Roland. What this means in terms of its effect on musicians -- and on music itself -- is a far reaching question, but one which will have to be posed at another time.

As said, in the analog era building one's own gear had obvious economical advantages. But this was not the only motivation by any means. Perhaps more important, it was a way to arrive at a *personal system*, whether this meant one instrument or an entire studio. Particularly in the area of electronic music, the features of an instrument determine what sounds can or cannot be produced; obviously the advantage of being able to determine these features (or at least many of them) should not be underestimated.

At present, the vast majority of electronic instruments being played have features determined by the R&D of some mega-corporation (and must I point out the unsavory quality of this fact?). In most cases the musician plays a part in determining the basic features of his or her instrument simply by purchasing synth A or synth B -- and I'm afraid that our alphabet is more than large enough to accommodate the current choices! Unfortunately or not, however, the practicality of building one's own synthesizer belongs to a time past. And the digital era has many advantages to offer which I for one would rather not do without.[1]

What I would like to suggest here is an approach to 'personal systems' which I believe to be more in sync with current times. In short, this is to use digital[2], mass-produced equipment as *elements* in the construction of more personalized instruments. I am inclined to say that in most cases this might imply a kind of *subversion* of the manufacturer's intentions, i.e., forcing the equipment into unforeseen applications. I should make it clear that I am not simply saying, "let's be more creative with our tools at hand"; rather, I believe that through experimentation and grafting one thing to another, a preplanned, integrated whole can be formed which performs a specific musical function -- that is, an instrument.[3]

FEEDBACK MUSIC

The personal system I have been working with during the past three years is described below. With it, I produce what I call "The Feedback Music". This has led some people to refer to my system as "the feedback machine", which, in relation to the present music is accurate. However, the utilization of feedback as a musical element is only one facet of the system's capabilities.

Feedback is the term used in electronic design for situations in which a system's output feeds back into the input, causing it to cycle through repeatedly. Many people are familiar with feedback as the annoying and undesirable wailing, screeching noise occurring in poorly set up microphone/public address

a. MODULAR SYNTH: First introduced by the famous Moog synthesizers in the mid-1960s, these instruments -- which established the word 'synthesizer' in the first place -- were characterized by the telephone switchboard-style cords which connected the various modules within the system.

b. EQ: Equalization, equalizer; simply put, tone controls. Extensively used in the production of most audio recordings, these devices adjust amounts of bass, treble, midrange, etc.

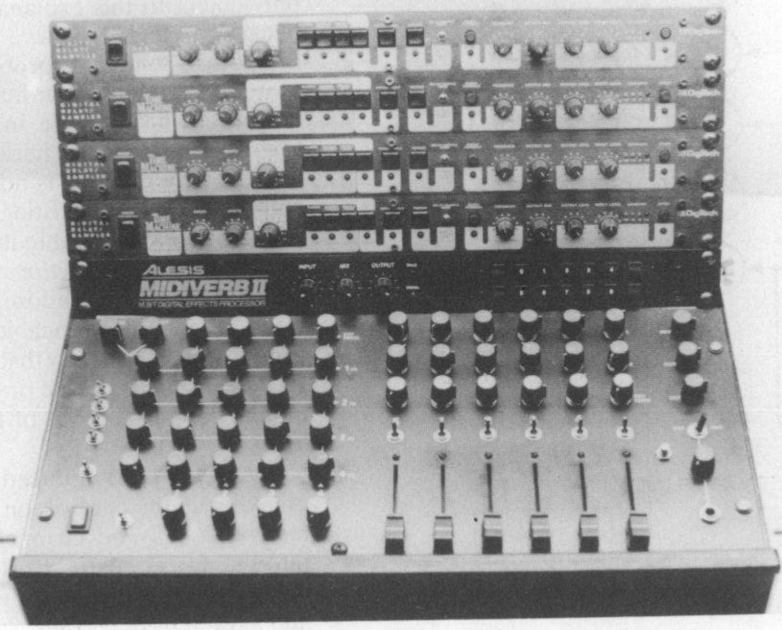
c. DX7: The beyond-immensely popular Yamaha digital synthesizer of the mid-1980s.

d. D.I.Y.: 'Do It yourself.' Not to be confused with the DX7 of the previous footnote, which is entirely different.

1. This is not to deny the merits of many musicians' preference for older technology (e.g., analog synths, tube amplifiers, etc.) or the outright damning of 'digital sound', and so on. In fact I am more sympathetic than not to such views.

2. Or or other low-cost, high performance devices made possible by recent technological developments.

3. Also please see Steve Rickard's interesting article, "The Tape Switchboard," in Re Records Quarterly Volume 2, Number 2.



systems. In this situation, the loudspeakers' output reaches the microphone, goes through the amplifier and out the speakers again, etc. -- a kind of vicious circle which creates the irritating feedback noise. However, the principle of feeding output to input can also be used deliberately for various purposes, and is commonplace in electronic design. The Feedback Music described in this article takes this principle as its basis.

My system is centered around the one piece of gear which has held my interest longest: the time- delay device. I well remember the day I first encountered an Echoplex tape delay unit (1965?) -- I had to be dragged away from the thing! My fascination has endured, but the technology involved was for a long time less than ideal. With the introduction of the Digitech 7.6 second digital delay (the "Time Machine"), I knew the time was right to produce a system based in time-delay ... long delay times, full bandwidth, complete modulation section, and -- knobs! A potentiometer-twister's delight, the Digitech is non-programmable and non-MIDI. Nifty features include one-shot sampler capabilities, and the ability to sync delay cycles to external triggers. And all this at a very reasonable price.

Even before getting the first unit home, I realized that my initial difficulty would be in overcoming built-in, mass market design limitations -- in this case, the unit's 'feedback' or 'regeneration' control. A common feature in delay units is a limited feedback system in which the delayed sound is re-introduced to the unit's input, creating multiple echoes or long, recurring patterns. But like the public address system situation described above, digital delays too can be fed overdoses of their own input. The problem arises if the re-introduced signal is strong enough so that it increases with each run-through, creating a cycle of increasing signal strength that quickly gets out of hand. In nearly all the delays being manufactured, maximum regeneration settings will not allow such runaway repeats, oscillation, etc., so that Joe Musician won't get scared and wonder what's broken! To set long loops to near-infinite repeats (à la Mr. Fripp --or should we say, his long line of predecessors), one must adjust regeneration just 'on the edge' of oscillation, something even Deltalab's 'Echotron' (designed for this application!) would not quite let the user do.

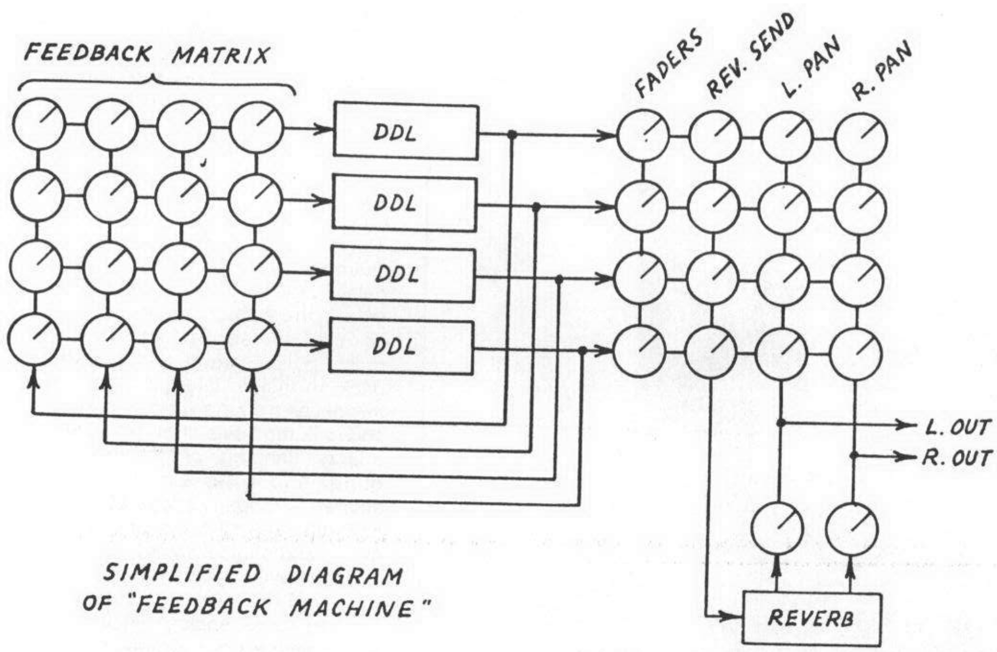
The remedy for this shortcoming is to tap off some of the output from the unit, and use an external mixer to add this to the input along with whatever audio signal is being fed in (the unit's 'regen' or 'feedback' control is doing the same thing -- just not enough of it). In a studio session this is easily accomplished through the mixing board, but to do this within a self-contained setup required the building of some simple mixing circuits -- no problem in my case, since part of my system concept was to take this much farther anyway.

ABOUT TIME DELAY

Among the most-used devices in the recording studio (and on stage as well), time delay is responsible for a wide variety of effects. 'Slapback echo,' heard on countless 1950s rock 'n' roll records (and heavily used by more recent 'Rockabilly' imitators), was an early example of time delay. Called 'tape delay;' tape recorders were used to create the characteristic echoing sound. A sound enters the machine, is recorded, and is played back an instant later. Combining this delayed sound with the original sound is the basis of all time-delay effects: flanging, chorusing, doubling, and echo simply utilize shorter or longer periods of delay, and different mixtures of delayed sound and original sound.

Tape-based delay was emulated by early solid-state devices now referred to as analog delay lines. Again, these units simply store a sound for a short time before spitting it out. By the mid 1980s the most widely used delays were digital delay lines (DDLs), capable of greater fidelity than analog machines, and often able to provide very long delay times -- two, four, or more seconds.

DDLs frequently contain a number of additional features for manipulating the delayed sound which is held in the unit's memory. First, and simplest, are potentiometers ('pots'), which are rotary knobs such as are used on a stereo's volume control. Being assigned to delay time or straight sound/delayed sound mixture, these can be adjusted directly by hand. Often a modulation section is found which adds an automatically varying delay time (via an LFO -- low frequency oscillator) responsible for the rolling timbral shifts of flanging, or the shimmering effects of chorusing. A few DDLs offer the ability to control the period of delay through external sources ('syncing' delay cycles by external triggers such as pulses from a drum machine or computer), or holding the sound indefinitely until a control signal calls for it to be sounded ('one-shot sampling'). MIDI (Musical Instrument Digital Interface) is more and more frequently implemented as well. Through it, synthesizers, computers, or other devices may command the DDL to change pre-programmed parameters of delay time, mix amounts, modulation, and so on. While of undeniable benefit, MIDI itself has become a source of heated debate within the electronic music community, another item unfortunately outside the scope of the present article.



My drawing will help clarify the basic idea; in essence, the mentioned add-on feedback mixers allow each delay unit to feed its *output* (in varying degrees) into its *input* -- but also, to feed any *other* delay unit in the system. Carrying this to its extreme resulted in the 'feedback matrix' of the final design. As far as **The Feedback Music** is concerned, this matrix is the heart of the system.

Four delay units are used. Besides their connections to the feedback matrix, the outputs are also routed to a simple mixing board with pan controls, reverb sends, slide-pot faders, and high-cut switch. Output is stereo, and there is provision for a stereo auxiliary input and a spare mixer channel. In addition to the digital delay lines' input connections to the feedback matrix, signals may be introduced (via the matrix) from an external source; this input may also be brought up on its own mixer channel. Further, a headphone circuit may 'preview' this input source before it reachers the digital delays. Lastly, the matrix extends to a bank of effects send pots, and an effects return.

A programmable reverb unit, plywood enclosure with rack-mount channels, hardware, etc., complete the system, which is rather a complete electronic music studio in its own right. Here lies one of the unique aspects of **The Feedback Music** ... if you have followed me up to now, you realize that on its own, this system has no proper *sound-originating devices*. When producing **the Feedback Music**, the only starting point is feedback itself, within and between the delay units.

An important point arises here which should be discussed, and on the insistence of Bart Hopkin (this journal's editor), I'm going to try my darndest to make it clear. Often people ask me, "but where does the sound *originate* from?" Usually they mean to say, do you use a synthesizer, etc.? In response, I am always adamant about there being no "source" of the feedback sound -- at least, not in any conventional sense. The devices employed here are not designed to *create* sound -- they are being forced to do so. At the same time, it is true that something cannot arise from nothing, leaving the Book of Genesis aside for the moment. Perhaps, as some have noted, there exists a residual "system noise" in the delays which, when a feedback path is created, is responsible for the arising of the audible feedback tone. I only object to this explanation because I do not believe that this noise -- something probably more like a faint hiss or hum -- is audibly discernable in the tone which results. The feedback, in other words, is not an amplification of an existing entity; it is a new entity unto itself, a result of a certain *action*. My position is a rather philosophical one, and objectionable to some, but I prefer to say that the feedback sounds, for all practical purposes, arise out of thin air!

Once feedback is induced (by cranking up the controls on the matrix) it may be channelled into a number of paths: to other delays, the mixer, reverb, etc., and altered by delay time changes, LFO modulation, or the external retriggering of delay clock. A frequently used feature of the digital delays is the 'hold' or 'freeze' capability which traps the sound in the unit at the punch of a button. When this is done with very short delay time, oscillator-like tones are created and held. Longer delays create more complex cycling patterns.

In practice, the manipulation of all these various controls constitutes the playing of the instrument. Anyone familiar with delay units will be aware of the range of timbral qualities often imparted by them, particularly at shorter delay times. This characteristic, combined with the tones created by the feedback itself, and the cycling structures arising through longer delays, add up to a quite varied sonic palette which can be surprising given the 'simple' sound source. The shifting, dynamic timbres made possible through this feedback generation can easily surpass the static tones of synthesizers in complexity, albeit in a less controlled fashion. Additional effects are those of free-running oscillators, white noise[e], etc. On occasion I have conjured up some startling voices, animals, saxophones and more!

Performances of Feedback Music pieces -- whether a public performance or simply live-to-tape -- are done in real time, as improvisations. The techniques used in playing this instrument are, like the instrument itself, invented as I go along; this is part of the excitement in pursuing more experimental musical forms. One quality of the so-called feedback machine is that, due to the nature of the process, the basic sound-shapes which are grist to the mill (further processing, contouring, etc.,) are of limited predictability - - i.e., the random element can be so great that at times the experience of improvising a piece is rather like a boxing match or chess game -- a real challenge! I am never certain of the outcome

e. WHITE NOISE: An often-used sound source since the earliest days of electronic music; well known as the dense hiss one finds 'between' the stations of the FM radio dial. This sound theoretically contains all audio frequencies; the name derives from white light (e.g. daylight), which contains all colors.

f. BREAK JACKS: Commonly found on mixing boards, these are simply access points which are made available through plug-in jacks. The audio signal path may be interrupted and routed to a processing device, the effected signal then returned to the same point in the path.

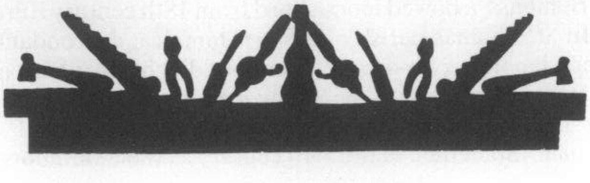
beforehand, and no two pieces are ever quite alike ... something I find quite invigorating after long experience with multitrack tape, MIDI, computer control, and such techniques which provide (demand) rather rigid compositional procedure.

Since construction of the 'personal system' I have been surprised at the possibilities within the Feedback Music approach, being drawn to it to the exclusion of other possibilities of the system. With external inputs, entirely new forms present themselves, from synchronized, multichannel loop music to 'slice and dice' forms, sampling bits of input sounds or the outputs of companion delay/samplers within the system. *Break Jacks*[f] on the rear of the enclosure facilitate the access to the digital delay audio inputs and outputs, trigger inputs, and other connections. Rhythm generators (I use a modified TR-505 drum box) can control the delay clocks or triggered sampling features of the delays, for complex rhythmic structures; I have also begun experiments with sequencer control using MIDI-to-trigger conversion. And aside from all this, the delay and reverb units -- through the access jacks -- all do double duty in regular studio use where such devices are indispensable.

Such are the possibilities of one 'personal system'. The point is, in an environment of specific-use devices -- many of which offer unseen capabilities -- it is worth considering to what unexpected ends these devices may be put, even to the degree of creating something essentially *new* in function.

In closing, I should mention that, contrary to how it may appear, I am not 'trained' in electronics or instrument building. All of the circuitry described above is elementary, and easily learned by anyone with a certain amount of interest and motivation. What appears complicated is often simply an aggregation of a number of basic, common elements. What one needs to bring into the formula is a bit of ingenuity, experimentation, and 'systems thinking'.

David Myers, working under the title Arcane Device, has made recordings of the Feedback Music for several labels. All are available through Arcane Device, 228 Bleecker #8, New York NY 10024- 4420. Write for a catalog or make checks payable to David Myers. Recordings include: Arcane Device #1: Engines of Myth, LP, $10; Arcane Device #2, 4, 5, 6 and 7, all cassettes, $7 each; and Arcane Device 3: Improvisations for Feedback, two 7" disks, $5.



THE DIDDLEY BOW IN A GLOBAL CONTEXT

By Richard Graham

Richard Graham is an anthropology student, performer and instrument maker living in New Jersey. He makes and plays a variety of New World African instruments, and has studied extensively their history, development and distribution.

(continued from page 1)

were, in a semantic sense, experimental instruments.

A case in point is the glissed monochord zither played in some African-American communities of Tennessee, Mississippi, Arkansas, and Georgia. Variously called Diddley Bow, Jitterbug, or One Strand, this American monochord is part of an international phenomenon that originated in the Kongo/Angolan area. By examining this complex of chordophones, I hope to bring to fore the individual organological traits that connect them to their Kongo/Angolan precursers, as well as those which point to the innovations of creolization.

In Central Africa these monochords are usually derived from a rafia stem. A thin strip of the stalk is carefully separated lengthwise so that it remains attached at each end of the instrument. Underneath each end of the strip a corn cob bridge is wedged, simultaneously serving to tune the strip and raise it from the surface of the stalk. This idiochord zither is a multiple player instrument with two or more performers participating in the music making process. Player #1 percusses the string with two thin sticks while player #2 variously stops, glisses and hammers-on with a piece of calabash, a tin can, knife or other hard object. In some three-player variants, a third performer helps to secure the instrument with one hand while percussing the string with a similar hard object in the other hand.

Bantu peoples have introduced the playing technique of the glissed idiochord zither to !Kung Bushmen in Southern Angola, who employ it on their Kambulumbumba musical bows. In many cases a wash basin or calabash is placed under these instruments to serve as a subsidiary resonator.

Most remarkable about these glissed monochords is their cultural context as age set instruments for pre-teenage boys. Mastering the basic elements of African music on these instruments, the boys later abandon them for more sophisticated adult instruments such as pluriarcs and lamellaphones. This context continued in the Mississippi Delta, where many celebrated blues guitarists started playing music initially on the diddley bow, graduating to the guitar by their teens.

With the Kongo/Angolan population of antebellum Afro-America as high as 40%, it's not surprising that the glissed monochord made an impact on the musical landscape. David Evans' distribution map of 51 known diddley bow players shows the densest concentration in the Mississippi delta and surrounding area.

One form of the diddley bow is simply a wire extracted from a broom handle stretched over a wall, a door, or the side of a house. Varying between three and four feet in length, two makeshift bridges are wedged under each end of the string, with rocks, bottles, cans, or even bricks pressed into service. As in the Kongo/Angolan idiochord, these movable bridges ingeniously serve to tighten the string, which is essential for the instrument to sound properly. In the words of diddley bow performer Louis Dotson, "The tighter it is the better it plays, but if it's real slack, it ain't gonna do nothing."

Portable versions of the diddley bow consist of a wooden board with a wire string stretched over it. These variants doubtless represent the intermediate form between the popular U.S. wall model and its Kongo/Angolan precursers. The diddley bows I manufacture are of the portable type, roughly patterned after Eddie "One String" Jones' instrument, although sans the paint can resonator he employed.

In all these instruments the string is *percussed* using either the fingers, a pick or a percussion wand. I prefer the more African percussion wand, and use a flexible plastic plant stake to sound the string. Other performers use a stick, a nail, or a leather strap. In the other hand a slider is employed to give the diddley bow its distinctive sound, with the player often gliding between notes. I currently use an empty single serve vodka bottle, although knives, metal pipes, or similar hard objects are equally effective. A percussive, hammer-on approach is employed with the slider, punctuating the melodic aspects of the diddley bow with echoes of Central Africa.

In Venezuela, the instrument is known as Carangano, and appears in the idiochord, musical bow, portable board, and wall forms. Like the Kongo/Angolan instruments, it too is a multiple player glissed zither. One area of organological innovation is the utilization of a corn or seed filled gourd or dried animal bladder as a slider. This not only serves as a subsidiary rattle, but provides additional resonance as well. In many cases the Carangano is laid over a wash basin resonator, just as in the Kongo/Angolan variants. In two player models, player #1 percusses the string with a pair of thin sticks while player #2 slides with the gourd or bladder. In three-player versions, a third performer steadies the instrument with one hand while shaking a maraca with the other.

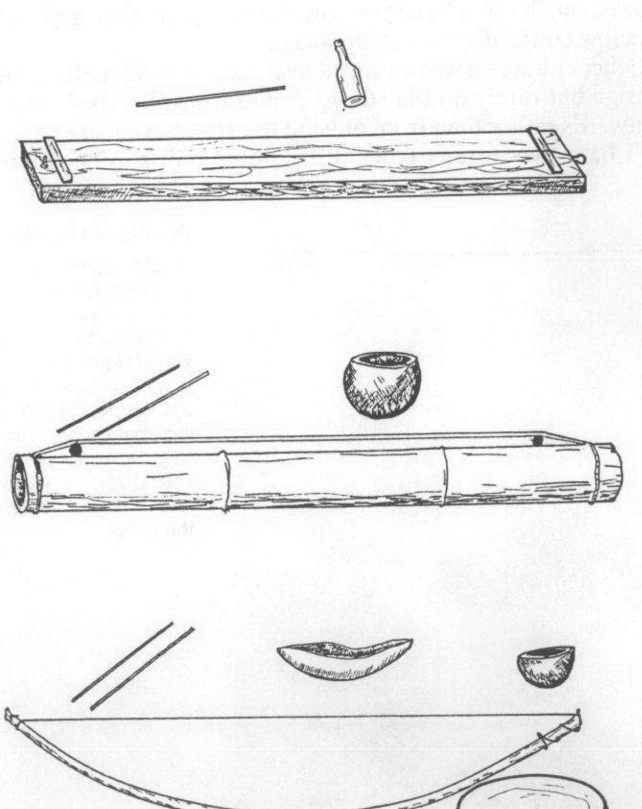
In Brazil a large musical bow called Berimbau de Bacia is played by street musicians in the northeast. Unrelated to the Capoeira wrestling context and the associated Berimbau de Barriga, the Berimbau de Bacia is played with a metal cylinder or bottle slider like the diddley bow. Both single-player and two-player versions are found in Brazil. With the bow secured to a pair of tin gas can resonators by player #1, the two player variant is sounded by player #2, who holds a slender stick in one hand to strike the string while sliding with a metal cylinder.

Gerhard Kubik reports an odd single-player version consisting of a large musical bow with a wash basin resonator/bridge wedged between the bow and string towards the lower extremity. Held vertically like a double bass, this Berimbau de Bacia is struck with a single stick held in one hand, while a small bottle held in the other hand is employed as a slider. This curious instrument bears a resemblance to the Bumbuss, a bowed monochord from 18th century Europe.

In St. Thomas parish of eastern Jamaica, descendants of Kongo laborers play a large bamboo idiochord zither called the Benta. This term is the Twi word for a Ghanaian mouthbow that was found in 19th century Jamaica, Brazil, and Surinam. Sometime in the 19th century as the mouthbow lost

its popularity, the term Benta began to be used for the glissed idiochord zither brought to Jamaica by migrating Kongolese indentured laborers. The glissed Benta is a multiple player instrument, player #1 striking the bamboo strip string with a pair of thin sticks while player #2 slides a large gourd over it.

The last area in which I find a variant of this complex of chordophones is Northwestern Mexico, where it is played by acculturated Cora Indians. My identification of the instrument, called Mitote by the Cora, as an African one, is controversial. A small group of Mexicanist scholars persist in the claim that Amerindians possessed the musical bow in pre-Columbian times. As time and space do not permit a full debate on the finer points of this anomaly, I shall here merely describe the Mitote, saving my theories for future publication. The Mitote is a musical bow laid horizontally over a large gourd resonator. In this respect it is similar to the Brazilian Berimbau de Bacia and the Angolan Kambulumbumba musical bows. The Mitote, however, is a single-player instrument percussed with two thin sticks, sans slider. In Venezuela, Araucano Indians have adopted the Carangano through cultural contact with Afro-Venezuelans, exemplifying the cultural patterning that caused African musical bows to diffuse so widely in Amerindian societies. In this light, the Cora adoption of the Mitote musical bow seems tenable, and its use in peyote rituals has a cultural equivalent in some Central African religions.



GLISSED MONOCHORDS

Top: Diddley Bow -- Portable board type with vodka bottle slider and plant stake stick. From the author's collection.

Middle: Idiochord glissed zither with stick and calabash or gourd slider. Variants found in Kongo/Angola, Jamaica and Venezueala

Bottom: Kambulumbumba glissed musical bow with sticks, calabash sliders, and wash basin resonator. Variants found in Angola, Mexico and Brazil.

The sweeping organological changes that have occurred since this complex of glissed zithers arrived in the New World prove how innovative Africans and Amerindians utilized technology and available materials to produce these experimental instruments from existing designs. As these instruments filled new social needs in new cultural contexts, their novel forms blended into the social fabric, obscuring their uniqueness as New World re-inventions. Now fully integrated, some cultural scientist relegate these monochords to the static context of "tradition," ignoring other possibilities.

Fortunately, the musicians themselves don't seem to subscribe to these ideas, and the continuity of the glissed monochord zither is insured by its creative renewal as each new generation of players brings fresh ideas. Recordings of electric diddley bows by Willie Joe Duncan, Lonnie Pitchford, and the author, hint at even greater musical possibilities. Sylvia and Robert Chapman have also created an innovative multi-string diddley bow they call the Wall Harp, apparently independent from the multi-string Carangano played in some Venezuelan communities.

Most innovative of all was the diddley bow's effect on Delta Blues slide guitar styles, which are directly attributable to this age set instrument. This was first suggested by David Evans, who linked the two phenomena in his 1970 paper, "Afro-American One-Stringed Instruments." Here, this scholar points out similarities in both technique and repertoire of the two instruments, and many of his informants mastered the diddley bow as children before graduating to the guitar. Some of the more noteworthy bluesmen such as B.B. King and Elmore James recall playing the diddley bow as youths. With historical references dating the bottle neck slide guitar style to at least 1903, it is safe to say that it developed independently of the Hawaiian guitar, whose mainland impact occurred at least fifteen years later.

In this framework, the percussive slide of the diddley bow continues to inform American music, and with slide guitarist Bonnie Raitt recently sweeping the Grammy Awards, the future of this instrument is strongly rooted in the experimental, as musicians constantly re-invent it.

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SOUNDING BOWLS

The search for harmony: Sound into form -- form into sound.

by Tobias Kaye

Tobias Kaye was born in Ireland and raised in England. He tried eight different types of work before discovering woodturning while working as a houseparent at a school in Gloucestershire. He now works primarily with wooden bowls. He has exhibited widely in England and the U.S., and written for Woodworker and Practical Woodworking *magazines.*

The idea of putting musical strings across a bowl occurred to me one night while I sat on the side of my bed trying to think of other things. Initially the idea I had was to fix a gut string across a bowl made from wet wood and allow it to be stretched by the warping of the bowl as it dried. This was fraught with problems, and I immediately added a tuning peg to the system.

But the true origins of my sounding bowls go back at least ten years from when the first one was made. When I first began turning bowls in 1978 I found the process of creating their curved forms so satisfying that my hobbies of playing the piano poorly and writing bad poetry went by the board and all my creative energy went into exploring bowl forms.

The bowl form, for me, is an allegory for the human soul. The bowl possesses an inner space, a facing edge or rim, and a partially unseen outer form including the base that rests on the ground. Correspondingly, the soul has its inner space, a face it projects to society, and a partly seen and known, partly unknown relationship with the natural world by which it is supported.

Thus, seeking harmony of form was allegorical for seeking inner creative harmony and development. The concept of an archetypal harmony of form fascinated me. Following philosopher/craftsman Professor David Pye's statement that a form either sings or is eternally silent, I spent years trying to create forms so intrinsically harmonious that they could almost be heard to sing (or hum) where they rested.

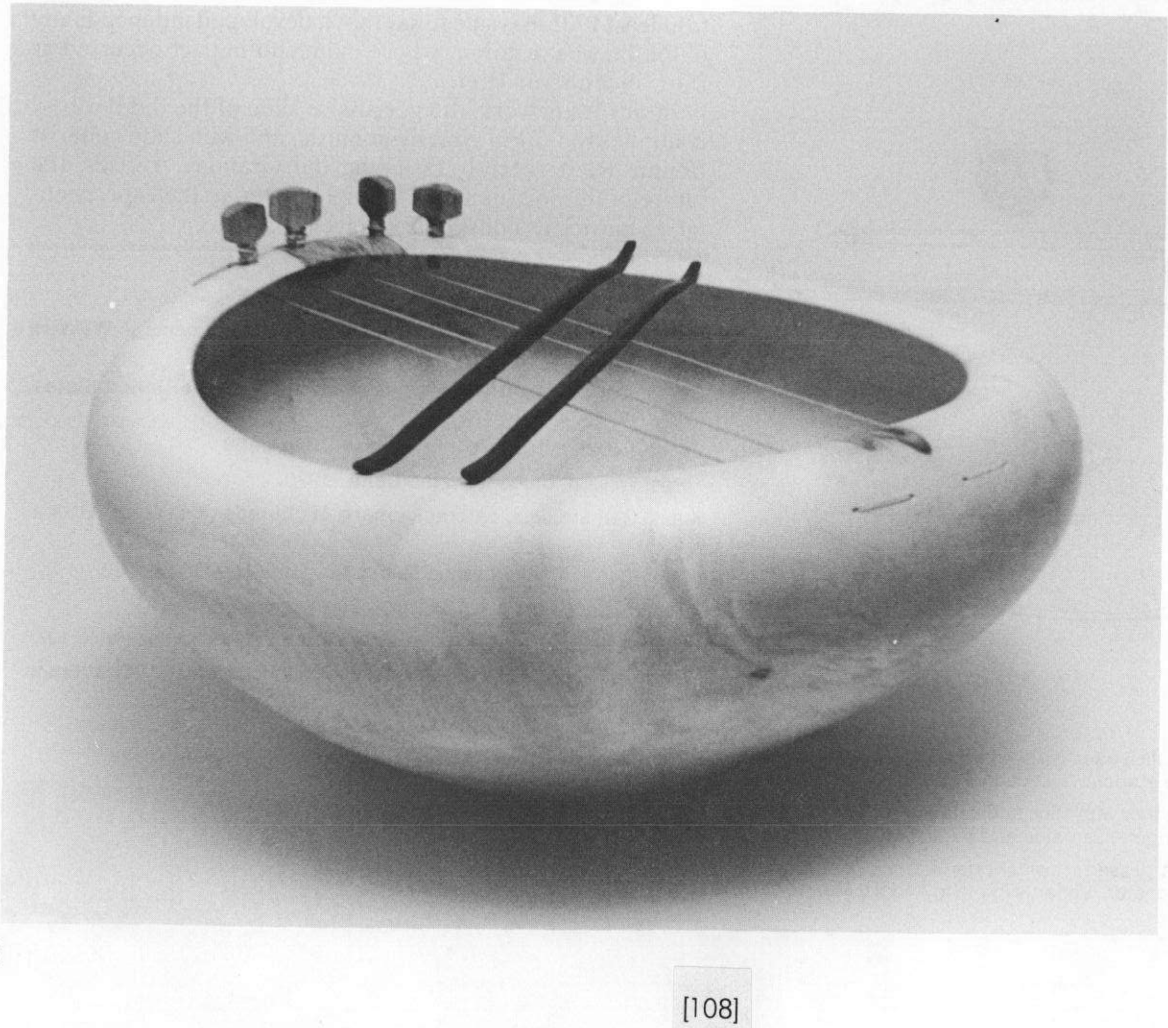
In 1986 I began to notice acoustic effects from the inner spaces of some bowls. One piece ("Acoustic Bowl" -- see the photograph), as it sat drying on the piano, suddenly split with a sound so musical that two rooms rang for a second or so.

This set me wondering till the answer came that night on the bedside.

A process of investigation then began, with deep narrow bowls, smaller and larger rim overhangs, thick, thin, wide and shallow bowls all adding their suggestions.

Other cultures have produced instruments of vaguely similar design but rarely do the strings sound from the inside space outwards rather than from outside the space inwards.

I have two distinct types of sounding bowls in occasional



SOUNDING BOWL #1

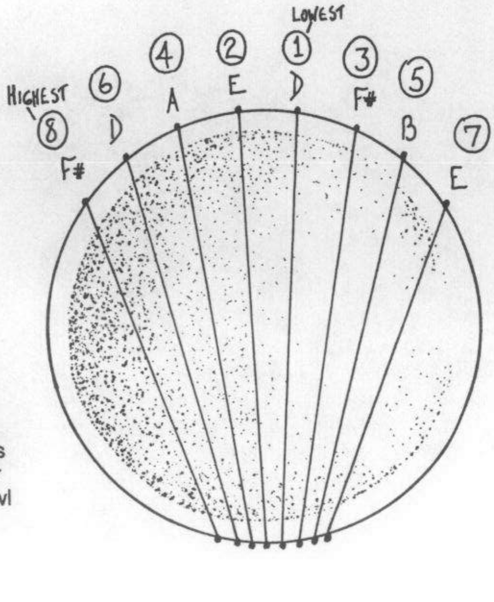
Apple, with African Blackwood pegs and bronze wound strings. The wood for this bowl was taken from the lower trunk of an apple tree. The grafting mark where fruiting wood meets rootstock is visible near the butt end of the bowl.

SOUNDING BOWL #24.

Cherry, with African Blackwood pegs and bronze wound strings; 23" in diameter. This bowl is so thin that plucking the string adjacent to an already sounding one causes a detectable but not disturbing wow. The strings are tuned to pitches outside the equally-tempered scale, in pairs pitched close enough to create beats. The range is approximately from C below middle C to A below middle C. This bowl's effect created for me the experience expressed in the title of this piece, "Hear in the Word the True I Am; Sing the Song of the Spheres."

production. One is the deeper bowl in which the strings fan out. These have to be tuned with the higher notes on the (shorter) outer strings, progressing inwards to the deeper notes on the long strings. The others are flatter bowls with parallel stringing over 5/8ths of the surface, tuned in linear sequence. The deeper bowls with bilateral tuning are more often bought as a sounding sculpture, while the flatter bowls, with their linear tuning, are much easier to play as an instrument.*

The string pattern and tuning sequence is finally decided only after the bowl form is finished. An example of a bilateral tuning appears below. The tunings are usually quite flexible though, and the customer who buys the bowl may choose to alter its tuning.



Sample bowl tuning. This is the pattern for Sounding Bowl #29.

The fact that these instruments have no history or tradition of right and wrong ways to play them seems to make the simpler to play one attractive to people who want to play something but are a bit intimidated by most "musical instruments."

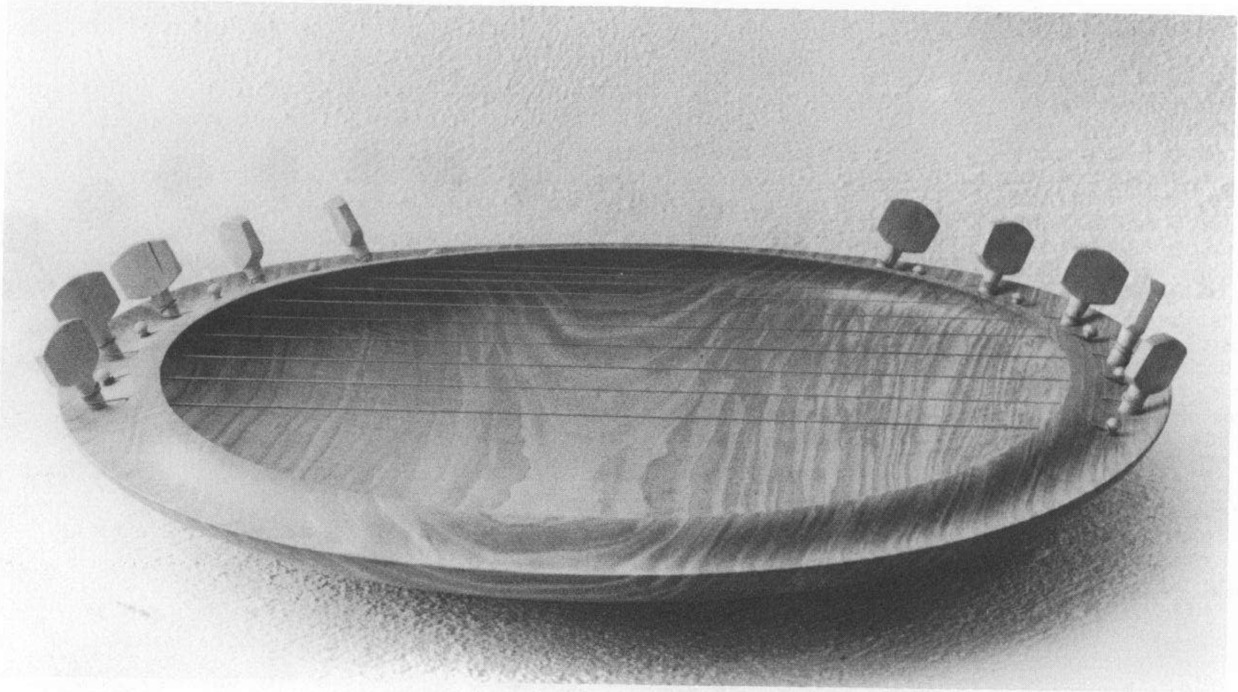
In forming the bowls I pay great attention to the "acoustic curve," listening with inner and outer ears for it to sound right as well as using the eyes and fingers to assess its harmony of form. Thickness is also important, being about one eightieth of the diameter for the deep bowls and about one fiftieth for the shallow ones.

Strings are fed through brass tubing inserted in the bowl walls. This brightens the tone and stops them cutting along the grain. I have used different sorts of strings at different times; currently phosphor bronze wound, steel core guitar strings are fitted to nearly all the bowls.

(more photographs overleaf)

*From the editor: The author has asked me to include here some observations I made in response to his mentioning that many people find the bilateral tuning described above confusing and the linear one easier to play. My comments were as follows:

"A left-right-left-right pattern like the one described for the deep bowls is used in many African instruments, most notably, kalimbas and koras. Lots of people find it very playable, very musical. It seems to call up its own kinds of musical patterns, which often have a lovely flowing quality. Maybe we should say to people who think it's not as easy to use musically, 'try it -- you'll like it!'"

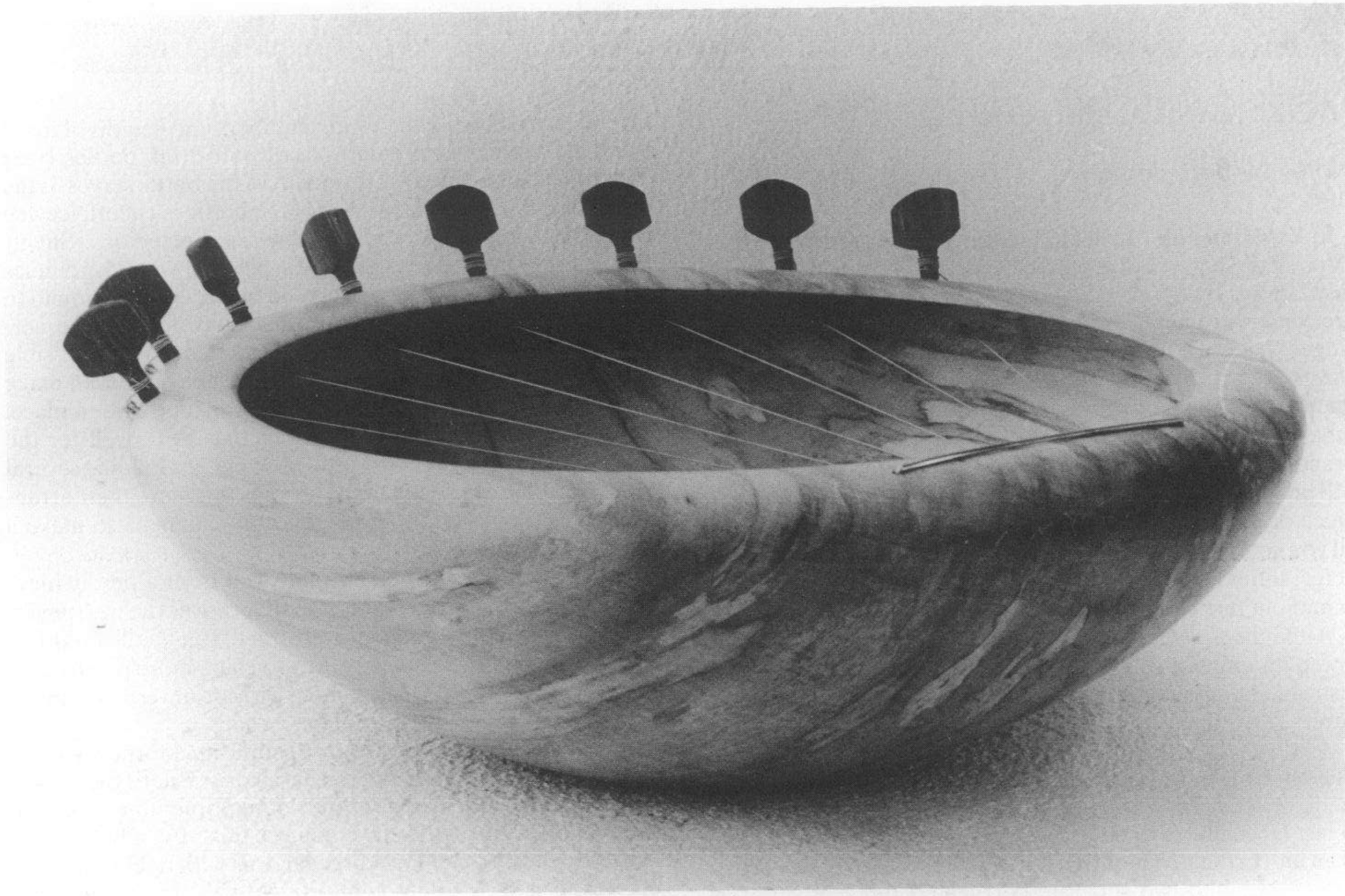


SOUNDING BOWL #25.

Rippled brown ash, with boxwood pegs and bronze wound strings; 181/2" in diameter. This was my third flat bowl, as deep bowls made the bulk of my developmental pieces. Ten strings tuned pentatonically make this type useful for playing early folk melodies. Various music therapists have taken an interest in the tone of these pentatonic shallow bowls, which they describe as very open, warm and available. Starting from F below middle C, the tuning is F G A C D F G A C D.

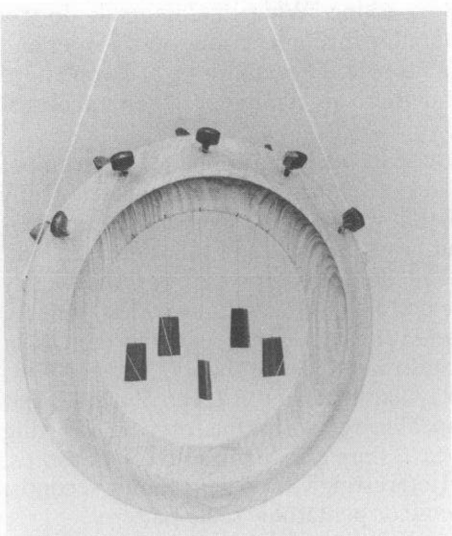
SOUNDING BOWL #30.

Sycamore, with Rio Rosewood pegs and bronze wound strings; 14" in diameter. Sculpturally this one was very successful for me; I like the gentle roundness. The tone also was gentle, not as bright and clear as some others. The tuning is pentatonic, altering left right left right.



SOUNDING BOWL #29:

Spalted sycamore, with rosewood pegs and bronze wound strings; 17" in diameter. This sharper-edged shape as compared to #30 gives a brighter tone. The overhanging lip not only assists the acoustic shape; it provides resistance to distortion from compression and stress under an estimated 190 lbs. pull (for this bowl). The brass wire clip on the butt end is a reinforcement, added after mending a stress-related grain failure (split). Also visible on this photo is one of the wheels or "nuts" made from a guitar-string ball-end on a copper staple. The string rotates over this wheel to transfer tension from the tuning peg to the string. With an overall angle of 140 degrees, this is a weak point in the deep-bowl design and causes string failure quite easily if over tightened.



Left: AEOLIAN BOWL

Ripple brown ash with African blackwood string beaters and rosewood tuning pegs; 19" in diameter. A cage of strings on this ash form contains windblown string beaters suspended on threads. With the strings tuned in pairs to create beats, it makes a very pleasing music.

Right: ACOUSTIC BOWL.

Turned from rippled ash while the wood was still wet (as is common with my pieces), this is the bowl that first set me wondering about making instruments from bowls, as it exhibited remarkable acoustic qualities, as described above.

MORE ON CORRUGATED HORNS

Notes by Bart Hopkin

In **Experimental Musical Instruments**' October 1989 issue (Vol. V #3) we had a pair of articles on corrugated tube instruments by Sarah Hopkins and Frank Crawford. These are wind instruments using tubes with regularly spaced lateral ridges. When a stream of air passes through the tube, standing waves are set up as the air bumps over the ridges. The frequency is determined jointly by the resonant frequencies of the tube, the speed of the air and the spacing of the ridges, and the practical result is that as the speed of the air increases, the tube will produce an ascending harmonic series. No special mouthpiece or embouchure is necessary to play a corrugated tube; all you gotta do is blow, or suck -- harder (= faster) for higher notes; softer for lower. You can play without pause, breathing in and out through the tube.

After the Crawford and Hopkins articles appeared, I followed an impulse to spend some time with corrugated tubes instruments myself, and I'll report some of my experiences here.

The starting point for my activities was the dual corrugahorns made by Richard Waters. (A photograph of these appeared in last December's issue of EMI.) These instruments consist of an un-corrugated mouthpiece/blow-tube leading to a T joint and thence into two separate corrugated tubes of different lengths. The tubes are flexible metal gas heater hose, a preferred material for the purpose because it works well and is widely available in hardware stores. Richard had the clever idea of stopping the two tube ends with the thumbs while blowing in the mouthpipe. One can thus control which tube will sound simply by lifting one or the other thumb (or both) to allow the air to flow through.

Why two horns? Because the harmonic series produced by a single horn is likely to have fairly wide intervals between the available notes (depending on how high or low in the harmonic series the horn's range lies). A second horn, tuned to the harmonic series based on a different fundamental, can help fill in the spaces. If one is not playing particular notes in a controlled melodic fashion, but rather using the corrugated horn for its appealing timbral and glissando effects, the second horn enriches the music simply by providing contrasting harmonic territory.

In thinking about these things, it occurred to me that I have several other fingers in addition to my two thumbs, and so it should be easy to control more than two tubes by the Richard Waters end-stopping method. I purchased some corrugated tubing and a lot of T connectors, and started assembling some more complex horns.

They did not work well. The reason, I suspect, was that all these interconnected air columns interfered and inhibited one another's resonances. I moved on to another approach, and this one proved very effective. The idea is simply to introduce each separate tube into a single, relatively large air reservoir, instead of having them directly connected to one another. Air flow through the reservoir can be maintained by blowing through a mouthpiece.

My actual arrangement is shown in the photo. I made several instruments with varying numbers and lengths of tubes using the top halves of large plastic soft drink bottles (very convenient; also cheap). The mouth of the bottle serves as the mouthpiece. The lower portion of the bottle is cut off, leaving enough above to form a reasonably-sized reservoir. Snugly fitted in the cut off end is a circular piece of wood with holes drilled in it to receive the corrugated tubes, cut and ground to length to provide the desired notes. Conveniently, the corrugations on gas heater hose are spiralled, making it possible to screw the tube end into a tight-fitting hole and even make fine adjustments in its position. Once the tubes are in place, it's easy to bend them into positions that work well for the player's hands and fingers. I used hose clamps holding several tubes together near enough to the ends to secure their arrangement. Positioned just right, the hose clamps also make a nice palm or thumb rest.

In addition to working admirably well from a purely functional point of view, the pop bottle shape gives the instrument a rather handsome form, in the abstract. But it still looks like a plastic pop bottle. So in an effort to claim more prestige for my work, I also made an instrument with an air reservoir made form one of our beautiful local hardwoods.

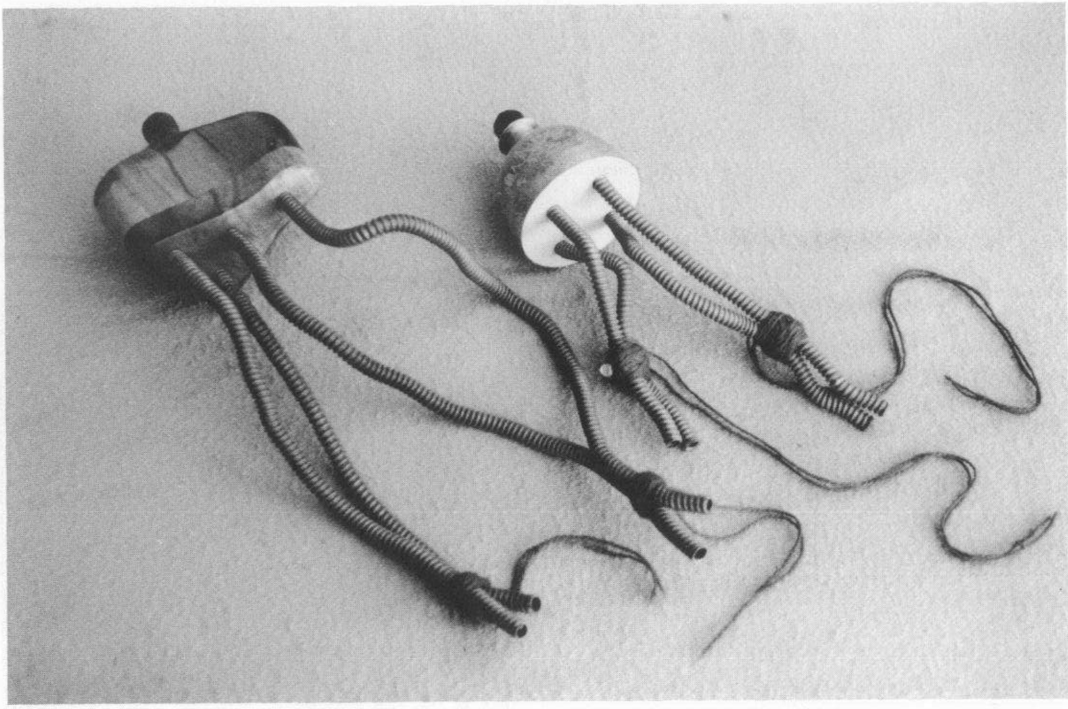
The tone of corrugated tubes is a simple, unadorned whistle. But they effortlessly give rise to characteristic note patterns as lovely as bird calls. The presence of multiple tubes tuned to different fundamentals only enhances this. Even before one learns to play the multiple corrugahorns with deliberate note choices, it is easy to get comfortable with the finger-lifting technique and produce charming, highly decorative (if arbitrary) melodies.

Learning to play premeditated melodies on corrugahorns takes considerably more time, because it involves mastering the delicate art of wind-speed control through breath pressure (recall that which note in the harmonic series sounds depends upon the speed of the air flow over the corrugations). As progress is made on that front, learning which finger to lift to open the tube having the desired note in its series is comparable to learning which valves to press on a trumpet.

By now, readers will be asking "What fundamentals do you tune the tubes to?" I thought through various possibilities and made several instruments with different tunings. I won't bore you with the details, but there are a number of general observations I can make.

If one were to play these instruments as one plays a trumpet -- that is, with deliberate note choices made in a context of fully chromatic music -- then it would make sense to take a trumpet-like approach and provide a series of tubes each a semitone apart, filling in all the half-steps between the widely spaced tones near the bottom of the overtone series. Indeed, that could be done, and very skilled players could then sit in with a symphony orchestra, at least in theory. But for now, most people won't play like that, and it turns out that what produces the most appealing results for the rest of us is having fundamentals which have simple recognizable relationships, such as 4ths, 5ths or (interestingly Phrygian) minor seconds; or, alternatively, diatonic or pentatonic scale patterns.

As we get down to the nitty gritty of tuning planning, we come up against an important and unavoidable physical consideration. It is this: the overall pitch range of a corrugated tube is limited by diameter as much as length. The air flow turbulence



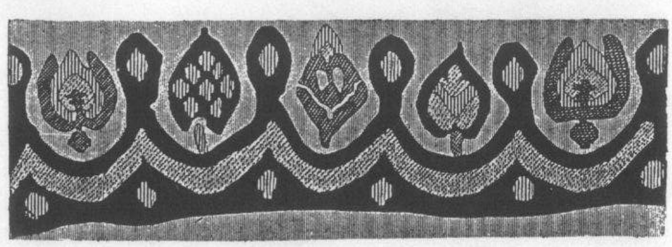
Two multiple corrugahorns. The one on the left has an air reservoir of California bay laurel; the one on right uses a sawed-off soda pop bottle.

that gives rise to the tone can only generate frequencies above a certain lower limit, which is lower for large diameters and higher for small diameters. If the fundamental for the tube length is below the lower limit, the tube will not produce that fundamental, but it will still produce the portion of its series that falls within the range limitations for that diameter. (The upper range limit is affected by a host of factors which I won't enumerate here.) Thus, several tubes of different lengths but the same diameter will produce different pitches depending on which tones of their series happen to fall in the playable range, but all of their notes will fall in roughly the same range. Note that a longer tube at a relatively narrow diameter, with fundamental well below the lowest soundable tone, will naturally produce pitches relatively high in its series. Since the pitches of the series become progressively closer together the higher you go, the long tube will have the advantage of producing more pitches within the range limits, but they will be correspondingly more difficult to control.

All this suggests that if we want to create an instrument with a large range and uniform production of the series, we should have a graduated set of corrugated tube diameters. Unfortunately, makers of corrugated tube instruments generally have to take what diameters they can get, and the range of available diameters is pretty limited. The commonly-used gas heater hose comes in 3/8", 1/2" and 5/8" sizes, but only the 3/8" size works well for typical human lung capacity. I made successful instruments, with workable tunings, using only this diameter. But that's not to say I didn't frequently find myself wishing I could find an identical tube with a diameter just an oonchion smaller. I spent a lot of time plotting out what notes would sound at what tube lengths for 3/8" tubes, and wishing I had the flexibility that other diameters would have provided in planning my tunings.

This led me to think about whether I could manufacture my own corrugated tubes at diameters of my choosing. Here's the method I came up with: Find some wire, maybe about 1/8" in diameter, that is firm enough to hold its shape well but soft enough to work easily. Find a strong rod or dowel whose diameter is the desired internal diameter for the corrugated tube. Take perhaps 12 feet of the wire, double it, and then wrap the two strands side by side in tight spirals around the rod. After wrapping enough to create a tube of the desired length, carefully remove one strand of the double wrap, leaving the other strand to form evenly spaced coils. Overwrap those coils firmly with duct tape, creating an air-tight covering over the spiraled wire. Remove the rod, leaving the hollow tube formed by the spiralled wire and the overwrapping, and trim the tube ends as needed. The corrugated tube created this way is ugly, and it lacks the convenient flexibility of the heater hose. But it works; it will sing.

With this technique I was able to increase my range of available corrugated tube pitches quite a bit, by creating very narrow, short tubes (lengths which would not speak at all at larger diameters). I didn't try to accommodate tubes made this way on my multiple corrugahorns, though -- it would have been quite awkward. My current fantasy is to make a little short-tube corrugated tube organ with them. I also did some experimentation with creating conical corrugated tubes, and tubes of uniform diameter but with a flared bell, still incorporating ridges, at the end. The results were pretty soggy, and this is not surprising: a change in diameter will lead to a change in air-flow speed as the air progresses through the tube, but the corrugahorn depends on uniform air speed over the ridges to generate its periodic vibrations.



THE VERRILLON, THE GLASS-ORGAN, A NEW GLASS HARMONICA, AND OTHER HISTORICAL GLASS INSTRUMENTS

By Sascha Reckert

This article describes two glass instruments that I have designed and built, the verrillon and the glass organ. I have also included notes on three glass instruments of the late 18th century which inspired me in the design of my own instruments: the *Euphon* and *Clavicylinder* by Ernst Chladni, and Christoph Friedrich Quandt's *Neue Harmonika.*

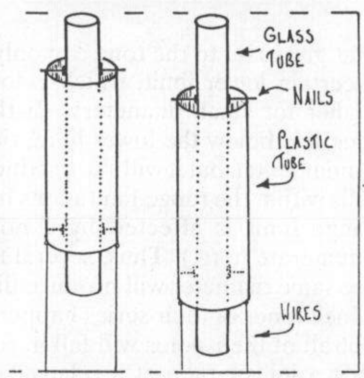
At right and below left: Sascha Reckert plays his Verrillon

Photo: Graphik Zeisel Ennigerloh

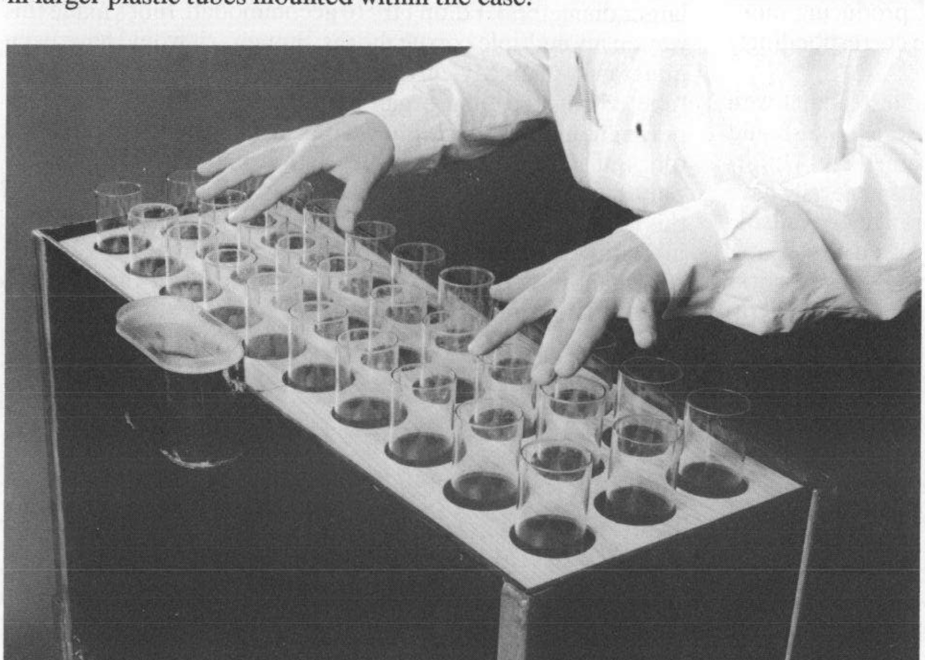
THE VERRILLON

The verrillon is a set of musical glasses played by the friction of a moistened finger circling the rim. Let me begin with some notes about names for this type of glass instrument. *Verrillon*, of French origin, and the German *Gläserspiel*, are historical names that have been widely applied to sets of musical glasses. *Glass-Harp* and *Glasharfe*, on the other hand, refer to a specific form of musical glasses created in this century by Bruno Hoffman.

My verrillon is a special one. I built it out of glass tubes, rather than the traditional wine glasses. The tubes stand vertically in a wooden case (see the photograph). This case has no resonance function. All tubes have the same diameter and the same thickness. The pitch of each tube is determined by its length alone; the tubes are not filled with water for tuning. Despite their vertical orientation, the tubes are suspended according to the same principles as xylophone bars: they are held at two nodal points. The vibration pattern of the tubes is likewise comparable to that of xylophone bars. Nails cemented to the walls of the tubes allow them to be held in larger plastic tubes mounted within the case.



Mounting system for the verrillon tubes:. Nails cemented to the glass sounding tubes at the nodal points are supported by larger plastic tubes. The different lengths of the glass tubes and different resulting nodal points require that they be mounted at different heights to keep the top ends at the same level.



Because the diameter of the tubes is only 5 cm, it is possible to play chords with one hand, even in the lower notes. The instrument consists of 30 notes, beginning with c. I play original compositions for verrillon by H. Genzmer ("Variationen"), J.P. Mittman ("5 pieces for flute and verrillon") and Fred Schnaubelt (solos and one composition for verrillon and full orchestra), as well as transcriptions of many styles of music.

THE GLASS-ORGAN

My second glass instrument is the glass-organ. I have taken this name for the instrument because it is a new instrument and the sound is similar to the real organ. Besides, it can hold one note as long as you want.

I designed the glass-organ, completed in 1987, because I wanted to construct a glass music instrument with more range and with the notes closer together. Today the instrument has six octaves and I can play one octave with one hand, so it's nearly like a keyboard instrument.

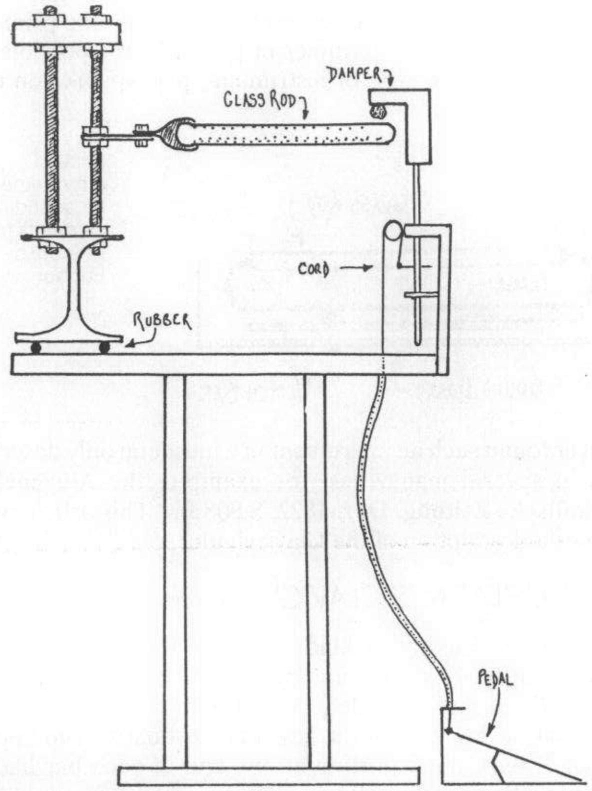
The process of playing is like most other glass instruments, with wet fingers, but the rubbing movement is forward and backwards, not circular. Now to the story of its development:

After 3 years' investigation, I visited Florence Baschet-D'-Errico in Paris to see her "Crystal" or "Crystal de verre," developed by the Baschet brothers (Paris).[For a complete description of this extraordinary system, see EMI /vol III #3.]* Then I read about the *Euphon* and *Clavicylinder* made by Ernst Chladni. I took several details of these instruments as well as the *Neue Harmonika* of C.F. Quandt, and developed some ideas of my own as well.

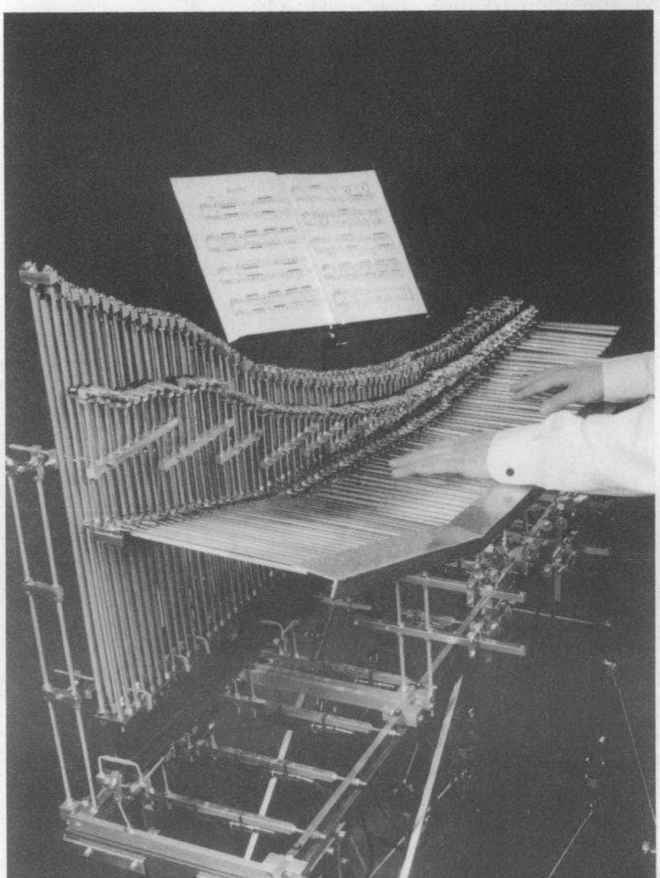
The glass-organ consists of glass rods working in conjunction with threaded metal rods. The glass rods are mounted horizontally, perpendicular to the upright metal rods (see the photographs). Vibrations created by rubbing individual glass rods are transmitted to the associated metal rods. The length of the metal rods determines the frequency. The glass rod functions like a key, and is not directly responsible for the frequency, much as in Chladni's Euphon. There are two parallel threaded rods for each pitch, in order to stabilize of frequency. This acoustic sound is amplified electronically, to reinforce the bass notes. The other important point is that I was able to develop a damper (like at the piano) for the glass-organ, so you can stop the note whenever you want.

ERNST CHLADNI'S *EUPHON*

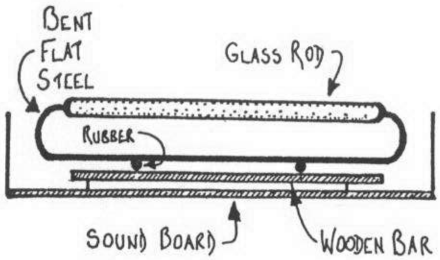
In creating the Euphon, Ernst Chladni's idea was to develop an instrument with wide dynamic capabilities and a big pitch range. In the year 1790, he finished his first Euphon with 4 octaves. Like other glass instruments, it was comprised of a tuned set of sounding elements, each producing one pitch. They consisted of a bar of flat steel curved up at the ends, with a hollow glass rod running lengthwise from one raised lip to



Above: A simplified diagram of the components of the glass-organ
Photos below: Sascha Reckert and the glass-organ. In the photo on the right, the damper bar can be seen beneath the player's palms.



the other. When stroked with moistened fingers, the glass rod transmitted its vibrations to the metal, which was the primary sound producer and determiner of pitch. It was possible to play quickly on this type of instrument, perhaps like on the glass-organ.

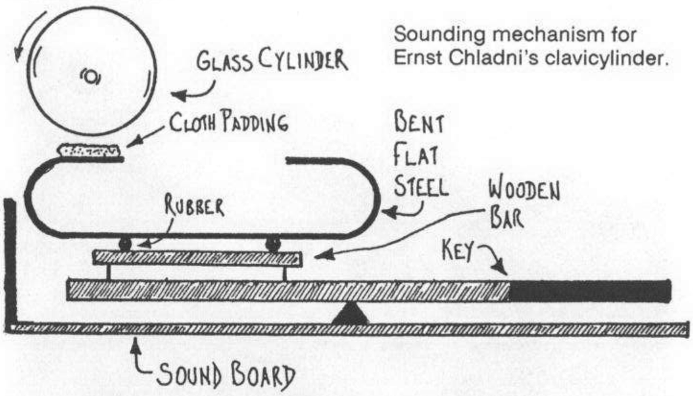


Basic arrangement for sounding elements in Chladni's Euphon.

I never found such an instrument in a museum; only descriptions in several magazines, for example, the **Allgemeine musikalische Zeitung**, Dez. 1822, S.808 ff.. This article also includes a description of the Clavicylinder.

ERNST CHLADNI'S *CLAVICYLINDER*

Following his Euphon, Chladni set out to develop a new keyboard-instrument. He mounted the flat steel bars of the Euphon (bent on both sides, but without the glass rods between) on the far sides of the keys of a keyboard. The upper surface of the curved portion at one end of each bar had a piece of cloth or leather affixed. Pressing the key brought the covered part of the bent steel into contact with a rotating wet glass roller (cylinder). (You had to make the glass-roller wet with your hand, before playing the instrument.)



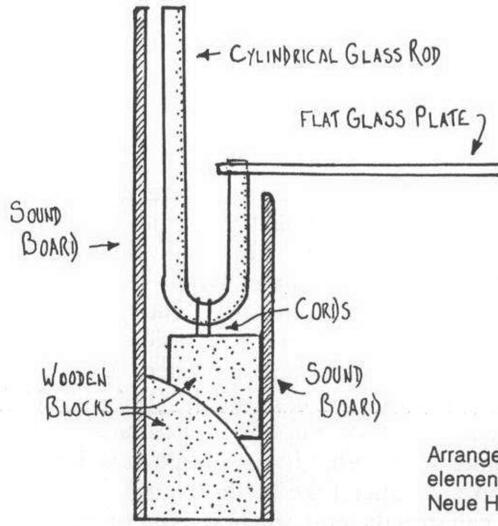
Sounding mechanism for Ernst Chladni's clavicylinder.

In the year 1800, he finished the first Clavicylinder. He could hold one note as long as he wanted and the dynamic range (controlled by pressing a key with more or less force) was very wide. The sound was similar to a glass harmonica, but with greater musical possibilities. So he could play almost any keyboard music on it.

I found the damaged remains of a Clavicylinder in the archives of the musical instrument museum in Berlin.

CHRISTOPH FRIEDRICH QUANDT'S *NEUE HARMONIKA* (NEW GLASS-HARMONICA)

Quandt's Neue Harmonika is nearly like the glass-organ, but instead of the threaded metal rods, he used sounding elements shaped a little like tuning forks of glass. One side of each fork, however, was only half as long as the other, and on this short side was affixed a horizontal strip of glass. The glass forks were arranged in a graduated row, with the strips pointing toward the player. Rubbing the strips with moistened fingers excited a vibration in the forks. Quandt designed this instrument to make a better glass-harmonica, so he didn't want to find a new name for his instrument.



Arrangement of sounding elements for Quant's Neue Harmonika.

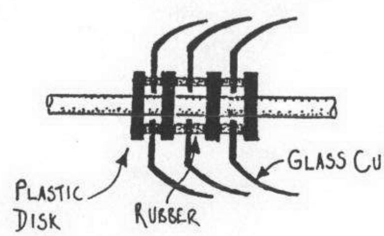
I found a description of this instrument in the magazine **Journal des Luxus und der Moden**, Dez. 1790. Quandt's first Neue Harmonika had 44 notes.

CURRENT WORK

In recent months I have constructed a new glass-harmonica working jointly with the Eisch-Glashütte in Germany. We decided to make cup- shaped wooden forms and then to blow the glass into these forms. This is the way glass cups were made historically. Made this way, the glass cups are very round, so it is possible to put them very close together. This makes it possible to reach an octave with one hand.


Cross section of glass cup shape.

As you can see, there is no neck at the base of the glass, and I don't use cork for mounting in the manner of other glass harmonicas. Instead, the base of the glass is flat and there is a hole at the center. The glasses are separated on the central spindle by spacers in the form of plastic disks with rubber pads. A nut at the end of the row of glasses holds the set in place.



Nested mounting system for the cups on the new instrument.

The tuning of the glasses was easy: grinding at the base lowers the pitch; grinding at the rim raises it. After the tuning process, the glasses were polished to remove any roughness. The range of the instrument is nearly four octaves, from e to c''''. The cups are rotated on the spindle by means of a foot mechanism. Photos of the instrument aren't available for this article, since in its new-ness it hasn't yet been photographed.

THE SMELL ORGAN

By Joseph H. Kraus

This article originally appeared in the June, 1922 issue of the now-defunct magazine, **Science and Invention**. *The editor, Hugo Gernsbach, produced several titles devoted to scientific advances that more cynical minds might regard dubiously. He and his exploits were the topic of an amusing article in the August 1990 issue of* **Smithsonian**.

This is the first of a short series of reprints that will be appearing in EMI, featuring early 20th century popular magazine articles devoted to unusual musical instruments.

Which one of us has not listened to the enrapturing tones of the church organ, or the pipe organs in motion picture play houses, and not awakened to its appeal? Now an entirely new organ has been developed, which instead of inspiring and thrilling audiences by sound, translates music into corresponding odors.

The suggestion comes from Dr. Septimus Piesse, a French chemist, who claims that every perfume produces its own particular effect on the end organs of smell terminating in the mucosa, or mucous membrane lining the nose. These organs are called the olfactory cells, and just as every note has its effect upon the ear and as the colors have their effects upon the retina of the eye, so this transposed music – *this music of smells* – will have its effect upon the olfactory organs. The range of notes has been carefully plotted, the heavier odors being assigned to the low notes, and the sharp pungent odors to the high notes. Thus, starting with the bass clef three octaves below middle C, the musical notes, and the odors assigned to them, are [listed at the top of the following page].

[Editor's note – In the following passage the author is assuming that the smell organ would be used to play olfactory transcriptions of the music of past masters.]

Of course, the combination of these odors will create a smell entirely different from any of the individual qualities of the various perfumes and it is necessary that, in the the soft, dreamy compositions, the odors blend harmoniously. Discords will have a decidedly unpleasant effect but inasmuch as the composers did not dwell upon discords to any great extent, the audience will be saved the rather unusual embarrassment of smelling disagreeable combinations. Some music would

Dr. Septimus Piesse, a French Chemist, is Sponsor for This New "Smell Organ", and He Has Worked Out the Elaborate Scale of Notes and Corresponding Odors, Which Are Shown Marked in Their Proper Positions on the Musical Staff in the Illustration Above. On the Right is a Musical Composition Combining Harmonious Smells in the Form of Chords. [Excerpted from the picture caption in the original 1922 edition.]

BASS CLEF	TREBLE CLEF
C, Patchouli	C, Rose
D, Vanilla	D, Vioilet
E, Clove Bark	E, Cassia
F, Benzoin	F, Tuberose
G, Frangipane	G, Orange flower
A, Storax	A, New mown hay
B, Clove	B, Arome
C, Sandalwood	C, Camphor
D, Clematis	D, Almond
E, Rattan	E, Portugal
F, Castorium	F, Jonquil
G, Pergulaire	G, Syringa
A, Balsam of Peru	A, Tonka bean
B, Carnations and pinks	B, Mint
C, Geranium	C, Jasmine
D, Heliotrope	D, Bergamot
E, Iris	E, Citron
F, Musk	F, Ambergris
G, Pois de senteur	G, Magnolia
A, Balsam of tolu	A, Lavender
B, Cinnamon	B, Peppermint
C, Rose	C, Pineapple
	D, Citronel
	E, Vervain
	F, Civet

perhaps have to be changed and the odors carefully graduated so that no particular perfume will predominate, except when the loud pedal, or rather in these smell organs, the *strong* odor pedal is trod upon.

It is, therefore, up to the perfumer to combine the mixtures in much the same way that an artist blends colors, or as a good florist makes his bouquet. If it is desirable to insert a little contrast into the bouquet, the appropriate blossoms or grasses are used, and so the perfumer likewise would have to employ the proper aromas.

The arrangement of the apparatus is such as to include five or more octaves of odors, arranged as shown in our illustration. These odors have been discovered and placed in their particular locations after painstaking research, the odors being arranged in bottles and sprayed up into the air by an atomizer-like action.

In each of the bottles, we may note the atomizer or sprayer attachment. These atomizers are actuated by keys on the piano. Pressure upon any one of the keys closes a circuit, which operates a solenoid, or suction type magnet, the latter releasing a valve and permitting compressed air from an air compressor and storage tank to blow the odorous vapor upward. In back of the individual spray nozzle is a funnel-shaped pipe likewise connected to a compressed air supply source. These create a constant draft of air blowing the odors upward and this draft is further facilitated by large rotary exhaust fans at the rear of the theatre. The strong pedal under the piano keyboard connects with the air supply compartment and operates an auxiliary valve which admits a further supply of air and consequently increases the amount of perfume and directly increases the strength of the odor.

It is possible that to rid the room quickly of any odor, ozonized air may be permitted to pass into the funnels.

Experimental Musical Instruments thanks Richard Moser for calling this article to our attention, and Charles F. Denny for providing materials and background information.

Books

100 YEARS OF THE MUSIC TRADES

Short review by Bart Hopkin

The Music Trades magazine has covered commercial musical instrument manufacturing in the United States since 1890. In celebration of its centennial year, the magazine has come out with a special issue entitled **A History of the U.S. Music Industry**. The entire issue is devoted to the topic, and it is both uniquely informative and wonderfully entertaining. The editors have culled from their archives a book's worth of historical information, plus scores of historic photographs and advertisements, to create a decade by decade tribute to the irrepressible inventiveness, genius, bravado and folly of American commerce.

And it's interesting to note that, according to this account, much of the flavor of American commerce that we take for granted today took shape early on in the musical instruments manufacturing industry. Musical instruments were among the first consumer products, for instance, to promote strong brand name identification. From this opening observation, the **Music Trades** history goes on to open unexpected windows on American social history, immigration and demographics, popular culture, economics and, of course, the evolution of manufacturing technology. Among the photographs you'll find the earliest electric guitars (with a Rickenbacker looking like a pie plate on a stick), all manner of self-playing mechanical instruments, piano soundboard spruce being used to make airplane wings during the Second World War, and Richard Nixon signing an executive order granting the piano industry tariff relief.

At this point I can't resist extracting one particular vignette. In the chapter recounting the industry's struggles during the depression, this passage appears under the heading "We'll Try Anything":

> At a 1932 meeting in Chicago, the American Association of MusicalMerchandise Manufacturers proposed the idea of installing a ukulele in every automobile so that passengers could properly entertain themselves on a long journey. Jay Kraus, president of the association and president of Harmony Guitars, reasoned, "Since radios are now being installed in autos, there surely should be a place for the ukulele." The association drafted a letter to Henry Ford offering 1,000 ukes, at no charge, to try out the idea. There is no indication that Ford ever responded to the proposal.

Music Trades magazines' "A History of the Music Industry" is available for $5 from **The Music Trades**, 80 West St., PO Box 432, Englewood, NJ 07631.

NOTICES

Now available on CD: CHRIST HALL, a composition by Thomas Bloch, commissioned for 1990 glass music festival, Sarrebourg, France. Scored for synth, male soprano & six glass instruments. Performers on this recording constitute a who's who in glass music. Available from Glass Music International, 2503 Logan Dr., Loveland, CO 80538.

QUARTZ CRYSTAL "SINGING" BOWLS -- perfect musical instrument -- each bowl plays a different musical note -- especially helpful for music therapy -- the bowls make people smile --they are perfect stress eliminators -- 12 sizes -- frosted & clear -- chakra-tuned -- all credit cards accepted -- The Crystal Store -- 1-800-833-2328.

WHERE SAWS SING AND FIDDLES BLOOM: A 60 minute cassette of duet improvisations by Hal Rammel and Johannes Bermark on musical saws, waterphone, melodica, and various instruments designed and constructed by Hal Rammel. Write: Cloud Eight Audio, 1622 W. Sherwin, Suite 2S, Chicago, IL 60626.

THE ONLY BOOK IN SAWING: **Scratch My Back: A Pictorial History of the Musical Saw and How to Play It**, by Jim Leonard and Janet Graebner. Features profiles of sawyers world-wide in 124 pages of fascinating information. Includes over 100 photos and illustrations, index and bibliography. U.S. Dollars $19.95, $3 shipping/handling (in CA add 6% tax). For information, contact Janet E. Graebner, Kaleidoscope Press, 28400 Pinto Dr., Conifer, CO 80433.

A string went into a bar. He sat there for quite some time, but the bartender ignored him. Finally he called out, "Bartender, I want a drink." The bartender, stony faced, replied, "We don't serve string here." Humiliated, the string was making for the door, when another string chanced to come in. "Don't bother," said the first; "they don't serve string here." "Is that so?" said the other; "Well, we'll see about that!" Instead of heading for the bar, the second string went into the restroom. There he proceeded to tie himself up into a tangled snarl. He pulled all his loose ends looser, with stray threads and frazzled tatters everywhere; he looked a terrible sight -- then he went and sat at the bar. "Bartender, I want a drink." "We don't serve string here," said the bartender. "Bartender," the string repeated, "I want a drink." "Didn't you hear me? I said we don't serve string here! You're a string, aren't you?" "Nope," answered the string. "I'm afraid not."

JUST INTONATION CALCULATOR by Robert Rich and Carter Sholz. A composer's tool for just intonation. Internal sound for tuning reference; microtonal ear training; shows modulations; reduces fractions; converts between ratios, cents, and Yamaha tuning units; MIDI tuning dumps for many brands of synthesizers. Requires Macintosh with Hypercard -- only $10.00. Soundscape Productions, Box 8891, Stanford, CA 94309.

EMI BACK ISSUES: Back issues of **Experimental Musical Instruments** numbered Volume VI #1 and later are individually available for $3.50 apiece. Earlier issues are available in volume sets of 6 issues each, photocopied and spiral bound: Volumes I through V, $14 per volume. Order from EMI, PO Box 784, Nicasio, CA 94946, or write for complete listing. Corresponding cassette tapes also available for each volume; see information below.

CASSETTE TAPES FROM EMI: **From the Pages of Experimental Musical Instruments**, Volumes I through V, are available from EMI at $6 per volume for subscribers; $8.50 for non-subscribers (each volume is one cassette). Each tape contains music of instruments that appeared in the newsletter during the corresponding volume year, comprising a full measure of odd, provocative, funny and beautiful music. Order from EMI, Box 784, Nicasio, CA 94946.

MICROTONAL MIDI TERMINAL (vers. 1.2) by Denny Genovese lets you play nearly any MIDI synthesizer in Just Intonation! A veritable "tuning processor" as well, it has many features for constructing, editing, transposing, analyzing and printing Just Scales. Tuning data is shown in Ratios, Cents, Frequencies and Yamaha TU's. Those without a MIDI instrument can hear the Just scales on the computer's built in speaker. Holds 16 scales in memory, which are selected by single keystrokes. Tunings may be transposed into any key with another quick stroke. Requires IBM XT/AT or compatible and, for performance, an MPU-401 or compatible MIDI interface. $60 from DENNYS SOUND & LIGHT PO Box 12231 Sarasota, FL 34278.

WIND, STRING, PERCUSSION DEMO/TECHNIQUE CASSETTE -- 60 min.. Waterphones on side A, many other instruments & sound devices on side B. Send $8 + $2 (pack. & ship. -- $3 for overseas). $8 is deductable from purchase. Richard Waters, 1462 Darby Rd., Sebastopol, CA 95472, USA.

The following selected list contains articles of potential interest to EMI readers which have appeared recently in other publications.

"Ideas on Making Oversized Harps" by Homer Welty, and "The Birth of the Mutant Ninja Harp" by Arne Langsetmo, in **Autoharpoholic** Vol. 11 #3, Summer 1990 (PO Box 504, Brisbane, CA 94005).

Two builders discuss their work with non-standard designs for autoharp. Both make instruments much larger than normal, work in just intonation, and have an interest in advances in soundboard design.

"A Swim with Dolphins" by James Oshinsky, in **Music for People /Connections** Winter 1990 (RD 4 Box 221A, Keene, NH 03431).

The author recounts his experience with dolphins under the auspices of a group in Key Largo called Dolphins Plus. At the end of the session, participants played a Waterphone in the water, and watched as the dolphins responded with seeming interest, curiosity and playfulness.

"In Search of Klyposeros: Mystery, Science and Discovery" by John Stoessel, in **Percussive Notes** Volume 29 #2, December 1990 (123 W Main St., Urbana, IL 61801-0697).

In the early 1920s, Deagan company made a series of xylophones using a wood identified as klyposerus -- apparently a deliberately mysterious fabricated name. This article describes an attempt to determine what species the wood really was. In doing so, the author also discusses the resonant properties of a number of tropical tonewoods. The mystery wood turns out to have been from a Bolivian species called Morado.

"Organ Donor: The Legacy of Hugh Le Caine's Electronic Instruments" by Gayle Young, in **Ear** Volume 15 #7, November 1990 (131 Varrick St., Room 905, New York, NY 10013).

A condensed history of Canadian musician and physicist Hugh Le Caine's diverse electronic instruments. Most of them can be regarded as early synthesizers or samplers, but with a particular emphasis on the capacity for subtle manipulation of timbral characteristics during performance. A recording of his "Dripsody" appears on a CD that comes with the magazine.

"Glass Harmonicas in Poland and Eastern Europe" by Piotr Wiench, in **Glass Music World** Vol. 4 #4, Oct. 1990 (2503 Logan Dr., Loveland, CO 80538).

A report on glass harmonicas in museums in Eastern Europe, with several photographs.

Also in this issue of **Glass Music World**: "Glass Orchestra Meets Enthusiastic Crowds in Far East Performances" gives brief highlights of the Canadian glass music ensemble's recently-completed tour of the Far East.

"Recreating the Famed Mason & Hamlin Piano", no author credited, in **The Music Trades** Vol. 138 #10, November 1990 (PO Box 432, Englewood NJ 07631).

Mason & Hamlin, once a respected name in piano making, suffered a decline in recent decades and ceased production in 1984. This article describes how a small company with a factory in Boston has acquired the name and is endeavoring to recreate the quality of the earlier instruments. The article contains both commercial history and information on construction procedures.

The Music Trades has also recently put out a special centennial issue, celebrating its 100th year of publishing. The entire issue is devoted to a history of the music industry in the U.S. **Music Trades** has a perspective and access to archives available nowhere else; the result is a wonderfully entertaining and informative history of American musical commerce.

"Flubbery Thwaps & Aqueous Warblings" by Mark Dery, in **Guitar Player** January 1991 (20085 Stevens Creek, Cupertino, CA 95014).

A one page report on various strange and wonderful one-of-a-kind plucked string instruments, focussing on several that have appeared in EMI and on the EMI tapes.

Andy's Front Hall 1991 Buyer's Guide and Sourcebook (PO Box 307, Voorheesville, NY 12816) has recently appeared, containing information on and photographs of the wide range of interesting and obscure folk instruments that Andy's sells (books & recordings too).

American Lutherie #23, Fall 1990 (8222 South Park Ave., Tacoma, WA 98408) as always contains several valuable articles. In addition to articles on guitar, lute and violin construction, there are these unusual features:

"Windows in Time: An Interview with Multi-Instrumentalist and Collector John Doan", by Jonathan Peterson. John Doan is an instrument collector specializing in the endless variety of small zithers and autoharps that were produced and sold particularly in the 19th century. Some quaint and wonderful old specimens are described and shown here, with names like the tremblein, the chartola, and the Woodland zither.

"The Swahili Kibangala" by James Hillier describes and presents plans for a type of plucked lute that was popular in Kenya after the middle of the last century, now apparently no longer built or played.

CAS Journal Vol. I #6 (Series II), November 1990 (112 Essex Ave., Montclair, NJ 07042) contains articles on the behavior of air resonances in violin bodies, accoustical properties of soundboard woods, and violin face plate tuning. Also included:

"The effect of wood removal on bridge frequencies" by O.E.Rodgers and T.R. Masino, appearing along with "On tuning of the violin bridge" by Jansson, Fryden and Mattson, discusses the tall bridge's function as, in effect, a band pass filter inhibiting high frequencies. It details findings on how selective trimming of the bridge can alter which frequencies are transmitted and which inhibited.

"Sympathetic vibration and coupling of resonances," by Carleen M. Hutchins, presents (among other information) results of measurements of the effect of sympathetic vibration from unplayed strings in conjunction with the primary vibration of a bowed string on a single instrument. The author finds that the presence of sympathetic strings, while subjectively enriching the sound, actually reduces the total sound energy output of the system.